The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. XXXIII. July 6, 1935 No. 836

Notes and Comments

The Glasgow Meeting

GLASGOW has been the venue for the annual meeting of the Society of Chemical Industry on four occasions prior to this year (in 1888, 1901, 1910 and 1922), but none has been more popular than that held this week. The technical programme was of a high order, the works visits were well varied and in many respects novel and the social events were of a character that appealed as strongly to the guests as to the members themselves. The papers were decidedly out of the ordinary. Starting with the President's discourse on national water supplies, the programme comprised an exceptionally interesting review of chemical engineering problems in the Navy, two papers at the Food Group session on food transport by rail and sea, and lastly, Dr. E. F. Armstrong's ably conceived and admirably delivered Medal Lecture on the past, present, and future. The annual meeting is somewhat of an ordeal for the president, the local secretary and the chairman of the local section, but so far as the 1935 meeting is concerned it must be recorded that Mr. Edwin Thompson brought a very active presidential year to a brilliant conclusion; Dr. I. Vance Hopper achieved a distinct personal triumph in the successful organisation of the meeting, and Mr. Thomas Donaldson made a particularly genial host.

In the uncertain years that have elapsed since the Society held its annual meeting at Glasgow, in 1922, the city has been through trying times, but its spirit has never flagged and this week it has welcomed the Society with the same Scottish fervour as it did on the four previous occasions. This spirit, which found official expression in the welcome offered by the Lord Provost, on behalf of the Glasgow University and Royal Technical College, at the business meeting on Tuesday morning, is shared by the committee and every member of the Glasgow Section. That it is appreciated by the visiting members is shown by the fact that the majority of them have prolonged their stay beyond the actual business session.

The Presidential Address

OUTSIDE his work in connection with the manufacture of chemical and pharmaceutical machinery, Alderman Edwin Thompson has a distinguished record of public activity. He is an ex-Lord Mayor of Liverpool, chairman of the Liverpool Water Committee and an ex-president of the British Waterworks Association. Having devoted many years to the administration of so essential a public service it was not unnatural that he should go beyond the bounds of the chemical industry for material for his presidential address and deliver a statesmanlike discourse on national water supplies. We have only to recall the work which Frankland and Armstrong began in 1865 to remind ourselves that the subject is essentially one for the chemist, and it was particularly appropriate that it should be dealt with at the first annual meeting of the Society after the greatest drought experienced in British history. Mr. Thompson gave a masterly résumé of the position in which we are placed to-day regarding water supplies and policy, and it was both suggestive and constructive. Only a few weeks ago the Minister of Health announced the formation of a select committee consisting of a number of members of both Houses of Parliament, and this committee, with the Water Survey Committee, formed earlier in the year, will go fully into the question from every aspect in order that the anxieties and hardships which many had to face last year may not be repeated.

When we turn on the tap, whether in the chemical works or in the home, we little realise that apart from the municipal water departments and the privately-owned water supply companies there are an enormous number of authorities whose interests and responsibilities are different, but concerned with the same object, namely, the flow and purity of the rivers. There are catchment boards, fishery boards, drainage boards, water supply boards, and, of course, the private riparian interests, and the question naturally arises as to whether or not there is the possibility of conflicting functions. Mr. Thompson is of the opinion that many factors affecting the problem of water supply indicate the need for more modern legislation, which would also remove some of the anomalies which exist between the general Acts and private Acts at present governing the subject, and simplify the administration of undertakings.

A Decreased Membership

TAKEN as a whole, the council's report, presented at the annual business meeting of the Society of Chemical Industry on Tuesday morning, was a record of satisfactory progress, but the membership returns indicated a slight loss during the twelve months. Last year the returns indicated a net increase of nine, but during the preceding three years there had been successive decreases of 55, 131 and 79. A reduction of six during 1934-36 need not, therefore, occasion serious alarm. It is more likely an indication of the need for co-ordination between chemical organisations than a sign of any falling off in moral support. It is to be

noted that measures are in preparation that should do much to establish a doctrine that membership of at least one of the two principal societies is a moral duty of every active unit in the industry. The local sections and the four subject groups record an eventful year. Modifications have been introduced in the Society's publicity department, and while we should like to pay tribute to those who have so successfully handled the publicity during the past twelve months we question the wisdom of any drastic economy in this direction.

Financially, the position of the Society is much the same as it was a year ago, but it is not clear how it is going to meet its increased obligation regarding the Chemical Society's library without widening the margin between expenditure and income. Great hopes are entertained regarding the outcome of the agreement entered into with the Chemical Society and the Institute of Chemistry, and the retiring president visualises an even greater measure of co-ordination than has yet been officially contemplated. A final note in the report announces the postponement of the Montreal meeting from 1936 to 1937, an invitation having been accepted to hold next year's meeting at Liverpool. We would reiterate a remark we made at the time the Canadian invitation was accepted at Cardiff last year—may the co-ordination of chemical organisations, by the time of the Canadian visit, have reached such a stage as to make the party that participates in the tour thoroughly representative of the British chemical industry.

The Medal Lecture

THE Society of Chemical Industry could not have made a more popular decision than to award this year's medal to Dr. E. F. Armstrong, whose services to chemistry for many years past have been of an outstanding character. One of the privileges attaching to the acceptance of the medal is the delivery of the medal address, and in this respect Dr. Armstrong was certainly not found wanting. It was, perhaps, unimportant that in visualising the past, present and future of chemistry he should have found it necessary to start on an alarmist note and talk so coolly about the next war, but it cannot be gainsaid that the last war found us chemically unprepared, and if it is true that another war will make an even greater, in fact, an unprecedented call on our chemical resources, it behoves us to be prepared to make in quantity all those substances which are likely to be required at short notice. His glimpses of the future, however, were much more concerned with the peaceful activities of the chemist than with preparation for hostilities. Dr. Armstrong foresees no end to the range of possibilities of such items as rayon, synthetic rubber, plastics and solvents, and he regards the present as a time for planning wisely and well. Now is the time, he says, to introduce new methods or economics into manufacturing processes. Chemists have their opportunity to-day as never before.

We looked in vain in Dr. Armstrong's lecture for any reference to the co-ordination of chemical organisations. While other leaders of chemical thought regard the closer union of the existing societies as of considerable importance, Dr. Armstrong is an ardent individualist and would fight his hardest to preserve individualism and all the rights it entails. At the same time, he admits that in certain respects it can be carried too far and he agrees that it is right that the principle of co-operation should be widely preached.

Institute of Chemistry Examinations

THE examiners of the Institute of Chemistry have issued their report, which is to be found summarised in THE CHEMICAL AGE, June 22, page 550. Much of this document is, of course, taken up by questions of fact, whether certain candidates did or did not answer specific questions. Taking the report as a whole, however, the unbiassed reader is constrained to ask what is the purpose of the Institute's examination. Is it an examination for those who are engaged in the practice of chemistry, or is it for those who are university students and who sit for the Institute examination at about the same time as they pass their university finals? If the former, there is little with which to find fault—except that there seems in that even little need for the examination. If, however, the examination is to prove the general fitness of the candidate for his career, then it would seem that there is too heavy a professional flavour about it. It is, of course, a heinous offence not to know "the action of nitrous acid on o-phenylene-diamine," and to attempt to "prepare indigo from aniline through anthranilic acid," but we suggest that for the industrial chemist these facts do not matter unless the candidate is engaged in industries wherein they are important. Plainly, they are just a matter of memory, not of knowledge.

The industrial chemist learns in the school of experience not to burden his memory with anything beyond fundamentals. The great thing is that he shall know that knowledge on whatever may be to him side-line subjects exists and shall know where to find that knowledge at short notice should it ever be required. It is recorded, for example, that "many candidates had no thorough experience of problems connected with water." Unless a chemist is engaged in the water supply industry, what opportunity has he, save in the purely elementary problem of softening the works boiler feed water? The point to our mind is that if a chemist should happen to enter the water business, has he the training and the mentality to equip himself at short notice for the work he has to do. The fact is, of course, that to-day most chemists do not flit from industry to industry. The dyestuffs chemist keeps to dyes, the fuel chemist to fuel, the alkali man to kindred industries. In that respect the examiners lay themselves open to the very grave charge of not knowing the conditions under which their candidates work, and of being unacquainted with the world for which their students are supposed to be prepared, when they say that candidates who are engaged in the laboratories of drug or pharmaceutical business houses "would be well advised to obtain experience in the laboratories of public analysts or other laboratories where food products are dealt with daily." One cannot, of course, question the desirability of this thorough practical training, it is the possibility of so doing that makes the recommendation amusing. If any of the examiners has had experience in applying for posts, and in the hours spent in writing letters of application in answer to advertisements, he will appreciate our amusement. There is much to be said for a thorough revision of the requirements of the Institute. The examinations should be designed not to test the memory of the candidate, but rather his capacity for becoming a leader in his particular circle of the chemical industry, such as would surely be expected of a Fellow of the Institute.

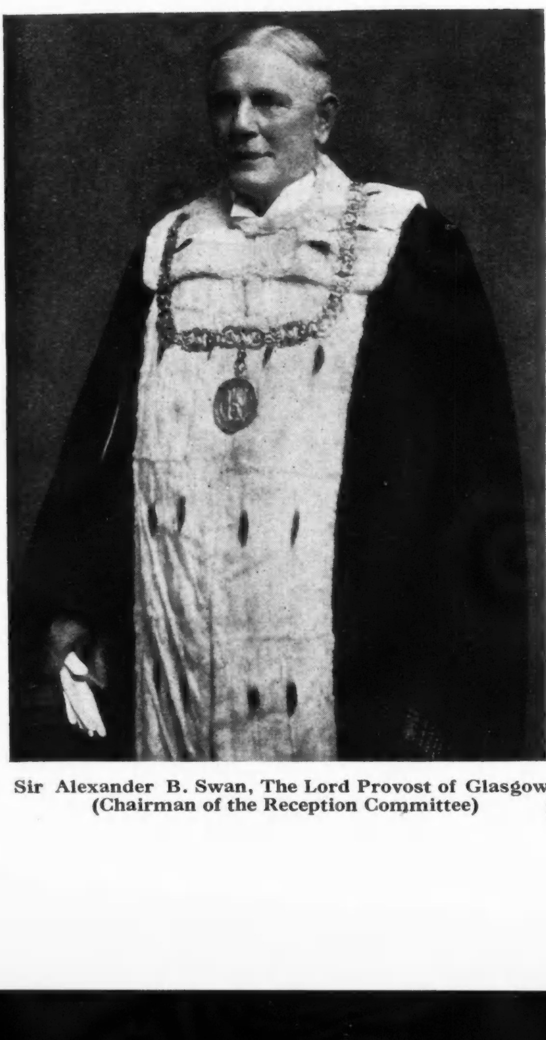
The Society of Chemical Industry

Fifty-Fourth Annual Meeting at Glasgow

Mr. W. A. S. Calder, the new President of the Society of Chemical Industry.

DESPITE a slight decrease in membership there was an increase in the attendance at the fifty-fourth annual meeting of the Society of Chemical Industry which opened at Glasgow on Monday evening and concludes to-day (Saturday). The meeting was presided over by Mr. Edwin Thompson, J.P., of Liverpool, and the arrangements were admirably carried out by the Glasgow section, of which Mr. Thomas Donaldson is chairman and Dr. I. Vance Hopper hon. secretary. The programme opened with an informal reception at the Central Station Hotel on Monday evening, when nearly three hundred members and friends were cordially welcomed by Mr. and Mrs. Donaldson. The Lord Provost and Corporation held a civic reception at the City Chambers on Tuesday evening, the annual dinner was held at the Central Station Hotel on Wednesday, and there was a reception at the Royal Technical College on Thursday evening. There were also, besides the technical and business sessions, a luncheon by invitation of the Glasgow section on Tuesday and a Food Group luncheon on Wednesday. The various works visits are referred to elsewhere. For the ladies, there were interesting excursions to the College of Domestic Science, and to Glasgow University, while a very popular feature of the week's programme was a garden party on Thursday at Eastwood Park, Giffnock, the residence of Lord and Lady Weir.

The annual business meeting was held at the Royal Technical College on Tuesday morning under the presidency of Mr. Edwin Thompson. The formal agenda was preceded by speeches of cordial welcome from the Lord Provost, on behalf of the City of Glasgow, Professor G. G. Henderson, on behalf of the University, and Dr. Robert Robertson, on behalf of the governors of the Royal Technical College.



Sir Alexander B. Swan, The Lord Provost of Glasgow. (Chairman of the Reception Committee)

A Welcome by the Lord Provost

The LORD PROVOST said it gave him infinite pleasure to welcome to Glasgow a Society whose members were of such great importance not only to the nation but to the world at large. Glasgow was an industrial city and its prosperity in the past had been largely built up by the experiments which had come from the chemical industry. The Society had honoured Glasgow by holding previous annual meetings in the city, and he was glad that they had come again. There was no better place in which to hold a conference, and he hoped every member would carry back the happiest recollections of the visit.

Professor G. G. HENDERSON, in welcoming the Society on behalf of the University, said there were a considerable number of members of the Society in the West of Scotland engaged in almost all kinds of chemical work, all of whom were delighted to welcome the members from other parts of Great Britain.

Dr. ROBERT ROBERTSON, as chairman of the governors of the Royal Technical College, endorsed the welcome extended to the Society by Professor Henderson and said it was fitting that the meeting should be held in a college which had been in existence for 140 years, and whose foundation was practically laid upon the industry with which the Society was connected. Chemistry was one of the first subjects taught in the college.

The PRESIDENT, in acknowledging the speeches of welcome, said he could never remember the civic head of any municipality welcoming the Society in such felicitous terms as the Lord Provost had used. The Society also appreciated the welcome extended to it by Professor Henderson and Dr. Robertson.

Membership

The annual report stated that the position of the membership was steady, the number of members elected and former members restored approximately balancing the losses due to deaths, resignations and deletions. The number of new members elected was fewer than last year, when the influx of newcomers due to the formation of subject groups was still in movement. The total of full members on the register at the present time was 3,809. Associate members and associates number, in addition, 301. The obituary list contained forty-one names—fewer than had been recorded for some years.

Recruiting the membership had not assumed as active a state as had been hoped, but measures were in preparation that should do much to make the work of the Society better known.

Dr. E. F. Armstrong, after a lengthy period as honorary foreign (overseas) secretary, had resigned from that office, and the Society was fortunate in securing as successor Dr. L. H. Lampitt, whose many activities abroad fitted him peculiarly well for the position.

Activity among the local sections had probably never been greater than during the session now closing. Every section had carried through a full programme of monthly meetings

and there had, in addition, been extra meetings to fit special occasions or circumstances arising through the year. To the close co-operation with the subject groups the local sections had contributed a very full share of support. Co-operation in meetings with other scientific bodies was more frequently noticed in the programmes. The quality of the papers presented was of a higher standard than in recent years. Though no new subject groups had been formed during the year the three younger groups had fully consolidated their positions. The membership of the Road and Building Materials Group in view of the highly specialised subject was very satisfactory at 176, but the officers were aware of a large number of potential members at present outside the Society and efforts were to be made to secure these. In no department of the Society's work had greater activity been shown than in the Food Group during its fourth year. The membership was approximately 400 and was steadily increasing. The Chemical Engineering Group, in its thirteenth session, presented a programme consisting of nine meetings, all but one of which were joint meetings with other sections of the Society.

Forthcoming Jubilee Lectures

For the forthcoming session the Society's Jubilee Memorial Lectures had been arranged as follows: Professor C. H. Desch, "The Metals in Chemical Industry," before the Yorkshire Section at Leeds, November 6, 1935; Birmingham Section, November 7; and the Liverpool and Manchester Sections jointly at Liverpool, February 21, 1936. Professor I. M. Heilbron, "Chemical Elixirs of Life: The Recent Developments of the Chemistry of Sterols, Lipochromes, and Related Compounds," London jointly with the Food Group, November 4, 1935; Nottingham, January 16, 1936; Edinburgh jointly with Glasgow at Edinburgh, February 28, 1936.

The report stated that considerable progress had been made in reaching an understanding between the three principal organisations in regard to matters of common interest. Details of the proposed agreement were known to most members. It was hoped that the agreement in the form finally approved by the lawyers appointed for the purpose would be sealed by the Society after it had been sealed by the Chemical Society and Institute of Chemistry. When this was done the new Chemical Council would be formed and would assume responsibility. It would be constituted by three members each from the constituent bodies and three appointed by industry. The council had nominated Dr. L. H. Lampitt, Dr. R. H. Pickard and Mr. J. Arthur Reavell as the Society's delegates for the first year.

An invitation on behalf of the Canadian Sections to hold the annual meeting in Canada in 1936 was extended personally by Mr. Whitmore during the South Wales meeting. It had been found necessary since to change that date to June, 1937.

The PRESIDENT, in presenting the report, referred to the understanding reached between the three senior chemical organisations with a view to closer co-operation, and said he was sure the Society of Chemical Industry would do everything possible towards the closest co-operation. He hoped that in years to come they might reach a closer co-operation than had even been envisaged at the present time. On the question of the general administration of the Society he said he would like to see the council, constituted very much as at present, meeting only once in three months and the affairs of the Society left to a much smaller executive committee of perhaps a dozen members, meeting regularly and reporting to the council.

Professor C. O. BANNISTER (Liverpool) said he had great pleasure, on behalf of the Liverpool section, in inviting the Society to hold its meeting next year at Liverpool. When the Society last visited Liverpool in 1924 Mr. Edwin Thompson was chairman of the section, and Mr. Gabriel Jones was an excellent secretary. Though times had changed, Liverpool would do its best to ensure a successful and enjoyable annual meeting in 1936.

The PRESIDENT, as a member of the Liverpool section, supported the invitation, which was cordially accepted.

The meeting endorsed the appointment of Dr. L. H. Lampitt as overseas secretary in succession to Dr. E. F. Armstrong.

The PRESIDENT expressed regret at the absence of Dr. Lampitt, who had undergone an operation for appendicitis, but announced his pleasure that he was making good progress and had sent a telegram conveying good wishes for a successful meeting.

Thanks were expressed to the governors of the Royal Technical College on the proposition of Mr. F. A. Greene, and a note of thanks was accorded to the officials of the Society on the proposition of Mr. MacCallum, a member of the committee of the Glasgow section.

Dr. R. T. COLGATE, hon. treasurer, presented the financial statement which showed that the amount by which expenditure had exceeded income was reduced from £311 to £136. In view of the reduced income from investments the accounts, he said, must be deemed satisfactory and the situation in face of the promise of increased subscriptions would be more comfortable than a year ago were it not for the additional liabilities incurred under the scheme for increasing contributions to the maintenance of the library.

The New President

The PRESIDENT announced the election of Mr. W. A. S. Calder as president for the coming year, and the appointment of vice-presidents and members of council as follows: Vice-presidents—Mr. Edwin Thompson (retiring president), Dr. J. J. Fox, Mr. C. J. T. Cronshaw and Mr. J. Davidson Pratt; ordinary members of council—Mr. H. Raymond Feeny, Mr. H. V. Potter, Mr. J. A. Reavell and Mr. H. W. Rowell.

Mr. CALDER, in acknowledging his election as president, said Mr. Thompson had filled the office so admirably that it would be exceedingly difficult to follow him. He was, however, confident in the support of his many friends and looked forward with pleasure to his year of office.

The PRESIDENT then delivered his presidential address, and was warmly thanked by Professor G. G. Henderson and Dr. R. H. Pickard, who paid a tribute to the comprehensive way in which Mr. Thompson had dealt with so important a subject as national water supplies.

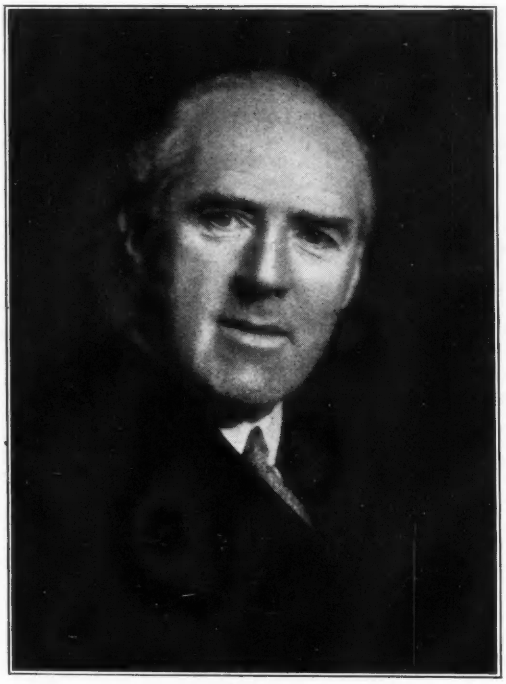
National Water Supplies

Mr. Edwin Thompson's Presidential Address

HAVING been associated for many years with the department of water supply of one of the largest cities in the British Isles, Mr. Edwin Thompson took "National Water Supplies" as the subject of his presidential address to the Society of Chemical Industry.

It was in 1868 that a Royal Commission was appointed to inquire into the domestic water supply of Great Britain and the pollution of rivers, and one of the recommendations was "that no town should be allowed to appropriate a source of supply which naturally and geographically belongs to a town or district nearer to such source, unless under special circumstances which justify the appropriation." Although it is nearly seventy years since that recommendation was made, there is, nevertheless, that same spirit of localism in connection with every scheme of magnitude, although no nearer town or district could possibly develop the large catchment areas to the full and economical extent that has been done by our large cities in the past. Furthermore, it must be realised that our towns and cities require to develop schemes in proportion to their size, and, of necessity, therefore, must look to sites geographically remote from the centre of population in order to obtain catchment areas of sufficient magnitude free from contamination and where the rainfall is comparatively high.

It has been the invariable practice of Parliament for many years past to incorporate clauses in a private Bill authorising the construction of waterworks, so that any local authority within a prescribed distance of the aqueduct may request a supply to be given, but the terms are usually to be agreed—although in many cases, depending on the strength of the opposition to the Bill, special clauses have been inserted imposing upon the promoters the liability to supply at fixed



Mr. Edwin Thompson, J.P., the Retiring President of the Society

prices which more often than not are onerous to the promoters. Such provisions would appear to be at least a partial solution to the rural supply problem.

The Report of the Water Pollution Research Board—of which Sir Robert Robertson is chairman—published last year shows what a serious problem still faces us. The very fact that the water undertakings in this country are so highly efficient has perhaps been partly responsible for the question of policy of water supply not receiving quite the attention it deserved. One or two outbreaks of water-borne disease and the draught of 1933 and 1934 focused attention on water supply, and recently the Minister of Health formed a committee of experts in their own particular field to survey the water supplies of the British Isles.

Rural water supply is a difficult problem and has been given special attention by the Minister of Health during the past year. The Rural Water Supplies Act, 1934, with its allocation of £1,000,000, has done much to relieve the situation, and out of 2,000 parishes which were in need 1,600 have already been dealt with and the work is in various stages of completion. You can take a horse to water, but you cannot make him drink, and you can take water to a rural district, but you cannot make the inhabitants pay for a piped supply; they regard rain and water as a gift of God and they do not see why they should be made to pay for it. They are satisfied with a water to which they have been accustomed all their lives and against which they are immunised but which would at once cause an epidemic if supplied to a city.

Emergency Legislation

Last year Parliament passed emergency legislation giving the Minister of Health power to issue provisional Orders, without the usual preliminaries of Parliamentary inquiry, to water undertakers to abstract water where they found it, or reduce temporarily the statutory amount of compensation water payable to the river. So far, 36 Orders have been issued by the Minister of Health, half of which concerned new sources of supply, and half dealt with the temporary reduction of compensation water.

The development of the Electricity Grid Scheme is also a matter of great importance affecting the use of our rivers, as large quantities of water are needed for condensing purposes, and, if possible, without the use of cooling towers—which add materially to the cost of generation. The most recently selected grid stations have, however, been erected in close proximity to tidal waters, a policy which is sound as regards both the reliability and the efficiency of the station, since there is no risk from the vagaries of rainfall, and presumably, as the grid scheme develops and the older and smaller stations become redundant, there will be a corresponding relief to the duty of the rivers.

Water supply legislation is another important factor and is inevitably connected with the question of policy. The laws governing the subject may be roughly divided into two classes: the general law as laid down in the Waterworks Clauses Acts dating back to 1847, the Public Health Acts, etc., and the specific law contained in private Acts of water undertakers.

The domestic wastage of water is very difficult to remedy. It would be beneficial if the population could be made to realise that a gallon of potable water is an expense, just as is a unit of electricity or a cubic foot of gas. In England and Wales the outstanding debt on the water undertakings of local authorities and joint water boards amounts to £148,000,000, and a capital of about £25,000,000 is invested in the water undertakings of companies. The enormous variation in the consumption per head in different districts proves that education in the use and misuse of water is desirable. The metering of all supplies other than domestic may, unfortunately, some day be necessary.

Dealing with overground sources of water, we have a number of authorities whose interests and responsiblities are different, but, nevertheless, concerned with the same object, that is, the flow and purity of our rivers. There are catchment boards, fishery boards, drainage boards, water supply Boards, and, of course, the private riparian interests, and the question naturally arises as to whether or not there is the possibility of conflicting functions. The Institution of Water Engineers, the British Waterworks Association, and the Water Companies Association are ever-watchful guardians of water supply and water policy and are always in close contact with the Ministry of Health.

Water Pollution Research

Dr. A. Parker, assistant director of Water Pollution Research, read a paper recently before the Leeds Section of our Society and referred to modern methods of disinfection of water in different parts of the world and also water softeners. In Many districts it is, of course, necessary, or at any rate desirable, to use water softeners, but we do not hear of water hardeners being used, and there is no need for investigation on this subject. The average human being delights in a soft water, the ladies when they wash their hands and the men when they shave, but does it give our bodies sufficient lime? There is the possibility of the desire and demand for soft water to become a craze or fashion not altogether to be commended. In industry it is different, as the manufacturer knows his requirements and can provide accorrdingly. The degree of hardness also plays a part in the everlasting problem of the most suitable material for pipes for domestic supply.

The city of Glasgow is in a lucky position with regard to its water supply. The water of Loch Katrine is so pure that they do not even have to filter it, and the strainers are of such a coarse mesh that they are designed only to keep comparatively large objects such as leaves, twigs, fish, etc., from getting into the pipes. Glasgow has a supply of 75,000,000 gallons per day from Loch Katrine, 23½ miles away; Birmingham takes the same quantity from a source 73 miles away, in Wales; Manchester draws 50,000,000 gallons per day from Thirlmere, 96 miles away; and one of Liverpool's supplies is capable of over 50,000,000 gallons per day from Lake Vyrnwy, 68 miles away.

An Increased Domestic Consumption

With the increase in the number of houses and the installation of baths, and the rapid increase in the number of motor-cars and the consequent use of more hose-pipes, and also an increase in small gardens and allotments, the consumption per head will increase very materially in the next ten years. In many cities in America they use 200 gallons per head per day. If the consumption of water per head does increase at the rate anticipated, then there will be the greater need for the organisation of systematic recording of data.

The purity of water supplied is taken for granted by the public, but it is always in the mind of the water engineer. Slow sand filtration and mechanical filters have reached a very high degree of efficiency. In 1892 the city of Hamburg had a terrible epidemic of cholera. In a few weeks out of

nearly 17,0000 cases 9,000 died. They were then drinking the unfiltered water of the River Elbe. Filtration completely eliminated the trouble. The storage of water is Nature's own way of purifying it to a standard. A single day's storage in a reservoir has been found to reduce the number of microbes in river water by 40 per cent. The late Sir Alexander Houston gave some striking examples of the effects of storage on certain microbes. He put cholera microbes into river water to the number of 13,000,000 to the cubic centimetre. After one week's storage they were reduced to 20 per c.c., and in three week's they were all dead. In a similar experiment with artificilly cultured typhoid bacilli he put 8,000,000 per c.c. After two weeks there were 30 per c.c., after three weeks only 4 per c.s., and at the end of four weeks they had all disappeared. He found that uncultivated bacilli perish much more rapidly than the cultivated, and it is, of course, only the uncultivated bacilli that would polute our water supplies. Sir Alexander Houston was one of the pioneers of the chlorination of water.

The storage of water, however, is not without its difficulties. It may kill certain microbes and bacilli, but, on the other hand, it may encourage the growth of plant and animal life. Sponges and polyzoa, algæ and mollusca in endless variety may get into the storage reservoirs and block up the mains to an alarming extent. At Newton Abbot a polyzoa (*Plumatella*) got into the mains and within a year was found in every part of the district. In 1911 trouble arose in the Cardiff waterworks owing to the presence of sponges, and was so extensive as to cause great anxiety not only by the reduced flow in the pipes, but also on account of the unpleasant odour. The chief trouble was in a 36-in. main which was encrusted with a luxuriant growth of sponges, some of them 8 in. long. One of the investigators said that, had it been desired to cultivate the organism, probably no better method could be devised. Local scouring and treatment with strong brine proved successful in eradicating the trouble.

Biological Troubles in Water Mains

Fresh-water mussels may suddenly appear, and in the sping of 1912 the diameter of a 36-in. unfiltered water main at Hampton-on-Thames was reduced to 9 in.: 90 tons of shells were removed. Minute crustaceans, such as *Cladocera* and *Copepoda* and others, may appear in overwhelming quantities. On one occasion one of the *Cladocera* appeared in such swarms that they continually clogged the screens through which the water passed on to the filters. During several weeks six men were employed day and night changing the screens: 10 tons of these organisms were removed. These are only a few instances, but there are scores of other animals that depress the soul of the water engineer.

Dr. H. T. Calvert, director of Water Pollution Research, in his report deals with many aspects of water supply and with the investigations initiated by the board. These cover purification of water for public supply, methods of treatment and disposal of sewage and trade effluents, and many problems of river pollution. Many of our water undertakings have to use polluted river water, after treatment, for domestic and industrial supplies. Yet with the increase of houses, industrial development, and consequent effluents, our rivers become dirtier and dirtier, therefore the chlorination of water supplies becomes more widespread.

Pollution by Industrial Wastes

Practically all kinds of industrial wastes may be considered as potential sources of pollution. Those which have not yet actually affected supplies may do so at any time, either by the location of the industry or by the necessity of taking a water supply from a source which is being polluted by such wastes. The Salmon Fishery Boards in Scotland are deeply concerned with the increase in disease owing to river pollution. The effluents from dairies and milk products factories have recently caused serious pollution in many cases, and the Rothamstead Experimental Station is investigating this source of contamination along with many others. Sewage disposal is naturally one of the major problems, and mention should be made of the work carried out at the London School of Hygiene under Professor W. W. C. Topley, and at University College, London, under Professor F. G. Donnan.

Sewage disposal and the effect on rivers of the discharge of effluent, particularly as regards water supply, is a problem which has given rise to considerable investigation; the general conclusion is that, whilst all reasonable precautions may be taken to purify the effluent, there is nevertheless the responsibility of the water authority abstracting water below the discharge to take all necessary steps to safeguard its consumers, having regard to the risks. The method of treatment of the sewage, and of course any water abstracted, will vary according to the state of the river, that is, according to the degree of dilution.

The question of sewage in the River Mersey has for a long time given rise to much controversy, and in April, 1933, the Water Pollution Research Board began an investigation with the object of determining the effect of discharges of crude sewage into the estuary on the amount and nature of silt and other matter deposited. It has been stated that the presence of sewage in the waters of the estuary causes more rapid sedimentation of suspended solids and renders the deposits more difficult to dredge. This investigation is being carried out at the sole cost of the Merseyside Local Authorities, the Mersey Docks and Harbour Board, and other interested undertakings. The chemical section deals with the methods of treatment of treatment of sewage, positions of outfalls, and volumes of sewage discharged into the estuary and also trade effluents. The biological section has consisted of a survey of the tidal sand and mud banks in the estuary with the object of distinguishing between banks which are more or less permanent and those which are subject to frequent movement. It will, of course, be a considerable time before the River Mersey investigation is completed.

There is room for some improvement as regards the basis of examination of water as to purity, and also the method of interpretation of the results. It has been suggested that analytical reports should be set out in some standardised form, but one must remember that the form of analysis will depend upon the subject for which the analysis is required.

Glasgow Entertains the Society

Local Section Luncheon

Following the presidential address, Mr. Thomas Donaldson presided at the luncheon on Tuesday, when the Society were the guests of the Glasgow section.

Mr. EDWIN THOMPSON, president, proposed the toast of the Glasgow section and thanked its officers and members for all they had done is connection with the annual meeting and for their hospitality on that occasion. He paid a special tribute to Dr. Vance Hopper, the hon. secretary, and said that only those who had performed similar duties in connection with other annual meetings knew what he was going through. He also thanked Professor Cumming and Dr. T. Love for the souvenir handbook they had produced.

Mr. THOMAS DONALDSON, in responding to the toast, also thanked Dr. Hopper and his colleagues for the work they had done. They were fortunate at Glasgow in having on their sub-committee several gentlemen who had served the organisation for many years and they appreciated their great assistance. He hoped the visiting members would spend a happy week in Western Scotland.

The Civic Reception

There was a large attendance at the civic reception at the Municipal Chambers on Tuesday evening. The Lord Provost (Sir Alexander B. Swan) and Lady Swan received the guests and they were accompanied by a number of magistrates and other civic dignitaries. The evening was spent in dancing in the banqueting hall and in listening to a programme of vocal music.

The Lord Provost offered a cordial welcome to the members of the Society, and said the important work which they were doing was not realised to the full by the people of this country. Chemical development in the past fifty years had made Great Britain much more able to compete in the markets of the world, and without science and the knowledge which it had brought to industry the British Empire would not stand where it did to-day.

Mr. Edwin Thompson and Mr. Thomas Donaldson expressed thanks on behalf of the Society. Mr. Thompson read the following telegram which had been received in reply to a message of loyal greeting sent to the King, as patron of the Society, earlier in the day: "Please convey to the members of the Society of Chemical Industry assembled at the annual meeting the King's sincere thanks for the kind and loyal terms of their message."

Chemical Engineering in the Navy

Commander Bedale Outlines some Problems to the Chemical Engineering Group

COMMANDER J. L. BEDALE, R.N., dealt with "Some Problems in Chemical Engineering which Arise in H.M. Navy" in a paper which he read on Tuesday at the Chemical Engineering Group session. Fresh water, he said, has always been of the first importance to seamen. A present-day naval water-tube boiler indeed is a very epicure and demands to be fed with the purest, de-aerated, distilled water obtainable. Failing this, corrosion, scaling, priming, or all three may be expected. Too much air and rust will appear; a trace of oil or a layer of scale-forming deposits and the tubes will overheat and distort; a pinch of salt and the water in the steam-drum will fly into a foam so that the lighter particles are carried away by the out-rushing steam, to cause possible water hammer in the steam pipes and certain erosion of the turbine blades. And so, where our grandfather used his tongue, maybe his nose, or at best a battered, brass-bound, shot-loaded hydrometer, we to-day employ quite delicate chemical tests (or so they seem to us) to determine the oxygen content, the salinity, and the alkalinity of the boiler feed water.

Priming Troubles in Boilers

Priming may be due either to foaming, that is to say, the formation of bubbles over the whole surface of the liquid, or to entrainment which is a mechanical process whereby drops of water are carried away by the velocity effect of the vapour. Entrainment can occur in any liquid, but foaming is dependent on the nature of the liquid. Scale on the heating surfaces is formed by those substances, such as calcium sulphate, whose solubilities decrease with increase of temperature. Substances whose solubilities increase with temperature, will, if concentrated beyond their saturation value, eventually deposit as sludges, but this effect is less objectionable. Corrosion and its causes are an extremely controversial matter, but broadly speaking it can be said that for corrosion to be continuous there must be a continuous supply of oxygen, since if the supply is cut off the action must cease when all the oxygen present has combined with the necessary quantity of iron. Oxygen, therefore, may be regarded as the prime factor in corrosion, but its action may be accelerated by the presence of other impurities. As a rule, acid solutions increase corrosion, and alkali solutions retard it: but there may be exceptions. Carbon dioxide is almost invariably present in water and forms a weak acid solution which consequently gives rise to corrosion. The action of certain salts may also favour corrosion, but this depends on their concentration; a low concentration causes accelerated corrosion but a heavy concentration may arrest corrosion; a heavy concentration, however, is objectionable because it causes deposits. Sea water contains some salts, such as those containing magnesium, which are cyclic in their action, that is to say, they cause continuous corrosion without renewal. Oxygen is not always necessary for such action, although it may accelerate it. Sodium salts are comparatively harmless from the corrosion point of view, but cause deposits.

Contamination of Feed Water by Oil

Lubricating oil in the days of reciprocating machinery was a constant source of contamination, and from very early days the use of vegetable and animal oils was banned, since it was realised that their introduction into the feed water favoured the formation of oxygen concentration cells and fatty acids, both of which, particularly the former, would attack the plates and tubes of the boilers. Only high-grade mineral oils were permitted, and filters of towelling or sponges were employed which required constant attention. In modern ships, almost all the auxiliaries, as well as the main engines, are turbo-driven, with the result that the need for internal lubrication of the working parts and subsequent filtering of the feed water has disappeared. Occasionally, for some special reason, a few reciprocating auxiliaries are still retained, and in these cases the exhaust steam from the reciprocating engines is kept separate from the turbo-exhaust and the condensate of the former is passed through a small filter, generally of the cocoanut fibre type. There is evidence to show that extremely small quantities of oil may contribute to overheating of the boiler tubes, and if a simple and highly-sensitive oil detector could be devised it would be of service, but none has so far come to notice.

Salt detectors and oxygen detectors, however, are available, and for the latter the process used is the well-known chemical titration method of Winkler.

Salinometers for salt detection make use of the well-known fact that the electrical resistance of pure water is very high, but falls off rapidly if certain compounds—of which salt is one—are added.

The ordinary nitrate test is very sensitive and, although its delicacy depends largely upon the illumination, and also to some extent upon the observer, it enables under average conditions, one part of sodium chloride in two million parts of water to be detected with certainty. By making use of potassium chromate as an indicator (Mohr's method), the test can also be used quantitatively. A measured sample of the water under test is made slightly alkaline (if not already so) and a few drops of potassium chromate are added as an indicator, turning the water yellow in colour. A standard solution of silver nitrate is then added slowly, the mixture being well stirred throughout the operation, till it changes colour to a reddish-yellow throughout. Observation of the amount of silver nitrate of known concentration necessary to effect this change enables the chlorine content of the water to be calculated. The chemical reaction involved is the same as for the ordinary silver nitrate test, namely—

Sodium chloride + silver nitrate = silver chloride + sodium nitrate, and after the reaction is complete, the excess drop of silver nitrate, which cannot be converted into silver chloride and sodium nitrate, forms the reddish precipitate with the potassium indicator.

A Satisfactory and Accurate Test

This test is a very satisfactory and accurate one, and is especially valuable, in the event of a feed reservoir becoming contaminated, in deciding whether the water is suitable for use subject to dilution, or whether it should be pumped overboard or otherwise disposed of. The instruments described enable dangerously high concentrations of impurities to be detected, and a few words may be added as [illegible] methods adopted to guard against the development of such concentrations and to mitigate the effect of such lesser degrees of impurity as cannot be entirely avoided.

Water should reach the boilers at a high degree of purity, but certain precautions are still necessary in the boilers themselves. Thus, the water in the boilers is always kept in a slightly alkaline condition by the use of lime. The test is generally made by means of two drops of phenol-phthalein to a test tube of water, when a light shade of pink indicates sufficient alkalinity. Usually it is only found necessary to add a very small quantity of lime which is conveniently done when filling the boiler after cleaning, and this generally suffices until the next occasion of opening. It is realised that this slight alkalinity actually favours corrosion, as compared with perfectly neutral water, since alkalis do not exercise an inhibitive action on corrosion until an appreciable concentration is reached. It is considered preferable, however, to accept this effect than to risk the possibility of acid conditions which would give rise to much more serious corrosion, while the higher alkaline concentrations are unacceptable from the point of view of deposits.

Boiler compounds purporting to cure all ills are legion, and in some other navies elaborate boiler water-conditioning is resorted to by such means, but this has been found neither necessary nor desirable in our Fleet, and the same remarks apply in general to evaporator scales and the many compounds offered for their mitigation. Zinc slabs are still fitted, but it must be admitted that there is little positive proof of their value for minimising corrosion. The traditional galvanic action, to which their possible protective action was formerly attributed is questionable, since metallic contact between the

zincs and the boiler is very soon severed by a layer of zinc oxide. It appears that their function, if any, must be to direct to themselves the action of any gases present. It may be added that prolonged trials, still in progress, show up to the present that no harmful effects result from the omission of zinc slabs entirely, and this is the present tendency.

Smoke screens made with the boiler fuel have the advantage that they can be produced instantly without previous preparation or warning, nor do they necessitate the provision of special stores. The appliance is extremely simple, and consists only of a jet led into the furnace high up in the combustion space, so as to be away from the swirl from the air cones. The objections to this method are that it tends to clog the boiler tubes with soot, and that in some conditions it forms a less satisfactory screen than that produced by chlorsulphonic acid.

The latter apparatus consists of 50 per cent. chlorsulphonic acid and 50 per cent. sulphur tri-oxide stored in steel drums which are kept at the base and decanted, as required, into containers carried by the ships. When required, the fluid in the container is discharged to the pipe line by means of a pump or by air pressure. The pipe line is led towards the stern of the ship where it divides into three leads, each terminating in a jet sprayer and each fitted with a volume-control valve. The settings of these valves are varied to suit the speed of the ship relative to the wind, and also for the prevailing atmospheric conditions which affect the persistency, and to some extent the volume of the smoke produced.

Corrosion by Smoke Screen Gases

Chlorsulphonic acid causes serious deterioration of structural steels, particularly those of higher quality, such as those used in destroyers, for which reason it is necessary to wash down and thoroughly scrub the structure near the apparatus after each occasion of use with a basic solution, such as soda ash in salt water. This is all very well in peace time, but in war may have to be deferred until after the damage has begun; consequently a smoke-producing chemical which did not suffer from this drawback and required less care in handling would be welcome.

The larger question of chemical warfare gives rise to no problems peculiar to the Navy; indeed, many hold the opinion that the use of such gases against ships is likely to be rare, since if it be possible to approach sufficiently near to employ them, explosives are likely to be more effective. Poisonous or inflammable gases or vapours, however, are apt to be found on board at all times in enclosed spaces such as bunkers, fuel tanks, double bottoms, and machinery cases, and special precautions are necessary to guard against their effects. The majority of these gases (such as methane), when mixed with air in certain proportions are explosive at ordinary temperatures, while higher temperatures and finely-divided matter such as coal dust, if present, usually increase the danger.

The instrument employed for their detection is the miner's safety lamp, and the method employed is to draw down the flame until only a faint line of blue is seen above the yellow centre. The presence of any gas in the air will then be shown by the appearance of a pale triangular " cap " over the top of the blue line. The " cap " is produced by the combustion of any combustible gases which there may be in the air, and the greater the concentration of these gases the larger the " cap." The degree of visibility of the "cap" varies according to the natural luminosity of the flame of the burning gas, for which reason it is difficult to observe hydrogen whose flame is almost invisible. When it has been said that it is possible in certain conditions for the " cap " to appear when no injurious gas is present, and that it is practically impossible to observe the " cap " in certain other conditions, although such gases are present, it will be agreed that the test is not entirely satisfactory, and that a better one would be a boon.

Gases for Disinfection and Refrigeration

Occasionally, gases are deliberately introduced into ships, particularly submarines, for purposes of disinfection. The most effective of these is prussic acid (HCN). Tins containing absorbent material of a cellulose nature saturated with the liquid are used, or alternatively the fluid may be released from cylinders under pressure. Owing to the danger to the operators, contractors who specialise in the process are engaged when it is necessary to use this method. A simple and less dangerous method, which can be used by service ratings, is sulphur. Sticks of sulphur are burnt in the space to be disinfected, the concentration required being 40 to 60 oz. per 1,000 cu. ft., and the time required about eight hours. A disadvantage is the corrosive effect of the gas, so that here again it would seem that there is scope for improvement.

Gases are also carried on board in connection with the cooling machinery. The refrigerant most commonly employed for the main cooling machinery is carbon dioxide, although ammonia (NH_3) is still met with in a few cases. For the smaller automatic refrigerators used for food lockers, soda fountains, chemical cupboards, photographic rooms, serum cabinets, and similar small detached services, stock commercial machines using various refrigerants, such as methyl chloride, sulphur di-oxide, and ammonia are accepted. In all large plants, however, CO_2 is retained on account of its low toxicity. This feature is of particular importance in submarines, where CO_2 alone is permitted, and even then provision is made for pumping out the whole of the charge to a special reservoir outside the pressure-hull in the event of a gas leak developing when submerged. In this connection it may be of interest to mention a refrigerant recently produced in America and generally known as " Freon " or F.12. Its full name is dichloro-difluoro-methane.

This fluid is a clear water-white liquid boiling at $-21.6°$ F., and is claimed to have advantages over other refrigerants in that it is the least toxic so far discovered, is non-inflammable, has no odour, has no chemical action on the metals commonly employed in refrigeration, and has working pressures above atmospheric, thus avoiding troubles due to inward air leaks. It is, however, miscible with lubricating oil, a disadvantage which it shares with methyl chloride.

It has been estimated that 29,000,000 tons of iron and steel are dissipated in the form of rust every year, and with it four or five times as much coal or coke involved in its production. These figures illustrate the economic importance of a problem which is particularly acute at sea owing to the salt-laden atmosphere. The effects of this attack on the hull and fittings of ships are, generally speaking, combated less by resistant materials than by the use of suitable paints and galvanising, or in the case of certain unoccupied internal spaces, such as torpedo protection compartments, by a coating of heavy mineral oil.

Protection of Under-Water Surface of Ships

It is not sufficient, however, to protect the under-water surface of the hull with anti-corrosive compounds only; it is also necessary to provide against fouling by the adhesion of marine animals and growths. The figures just quoted for the annual cost of steel corrosion are astonishing, and if a similar estimate were made of the losses due to the fouling of ship bottoms, the result would also be remarkable. All the dry docks of the world are filled for the greater part of the year, not with ships requiring repairs to their plates, rudders, propellers, or under-water fittings, but simply for the removal of barnacles, while every ship upon the seas pays a daily toll in extra fuel burnt. A concrete figure may help. The annual cost of docking the ships of our Navy alone, for this purpose, even at its present reduced strength is of the order of £150,000 a year. And yet it is economical to do so.

The present procedure with naval ships may be summarised. The submerged part of the hull is given two or more coats of anti-corrosive composition, followed by one coat of anti-fouling composition, the latter being applied immediately before the dock is flooded, owing to its deterioration when exposed to air. A belt averaging about 3 ft. wide, which is exposed to alternate wetting and drying, is covered with a composition known as boot-topping. The boot-topping is applied in the same way as the under-water composition, that is to say, anti-corrosive undercoating followed by an anti-fouling finishing coat. The anti-corrosive under-coatings are usually spirit varnish compositions consisting of naphtha or white spirit solvents, with a soluble medium of gums and resins and an insoluble paint medium of iron or zinc oxide. The anti-fouling composition contains solvents similar to those in protective paints with the addition of poisonous compounds of copper, lead, arsenic, or mercury.

An average analysis of a protective composition would yield approximately:—25 per cent. solvent (naphtha, paraffin, or white spirit), 35 per cent. soluble medium (resins and drying oils), and 40 per cent. insoluble solid (zinc or iron oxide, etc.). An average anti-fouling analysis would be similar, but the solid medium would be made up of varying percen-

tages of poisonous compounds (copper, lead, arsenic, mercury), according to the maker.

It is not only on the outer skin of the ship, however, that marine growths cause trouble. Unless steps are taken for their removal, they gradually choke the fire-main and other pipes to which they have access, while periodically they appear in bulk in the condensers or their inlets and choke the supply of circulating water; jelly-fish and sea-weed are particular offenders in this respect, and it is no unknown thing for a ship to have to stop while they are cleared away.

Mention may be made of the manufacture of oxygen in the dockyards in connection with oxy-acetylene welding and the saving of life; the production of enriched air on board ship for the charging of certain torpedoes; the maintenance of the large electric batteries fitted in submarines and the gases liberated therefrom; the nature of the brine employed in connection with magazine cooling machinery; the staining agents employed in the study of metals—the list could be extended, but a special word may perhaps be added as regards chemical fire extinguishers. The restricted spaces on board in which chemical extinguishers are most likely to be employed demand that they shall be non-toxic, but this is a requirement which few commercial types fulfil. Fortunately, water is always available on board ship and can be used in the majority of cases of fire, while steam has been found effective in the boiler rooms. Nevertheless, a fully non-toxic extinguisher for use in connection with petrol boats, aircraft, and electrical apparatus would be welcome.

We still lack facilities in several important matters and among other things we have no oil detector; a very imperfect means of ascertaining the presence of poisonous and inflammable gases; no way of observing continuously the oxygen content of the feed water; no method of descaling condenser tubes in place; and we lack a fully satisfactory solution of the ancient problem of under-water fouling.

Points from the Discussion

Owing to indisposition Dr. W. R. Ormandy was unable to preside at the meeting, and the chair was therefore taken by Mr. Stanley Robson, a vice-president of the Chemical Engineering Group. Mr. Robson said the main note of the paper was a call for the solution of a number of extremely interesting problems. Chemical engineers were specialists in the important territory, which lay between pure chemical science and engineering science, and they had many functions beyond those of being merely liaison officers. They had a field all their own, and he hoped that out of that meeting some valuable suggestions would be made in regard to the problems which had been so clearly laid before them by Commander Bedale.

Dr. W. H. Cullen said the paper was a modest, unassuming, interesting statement which the Group would be proud to have in its records. He was afraid that the affairs of H.M. Navy, so far as chemical engineering was concerned, had been a closed book to most of them. They had just taken the Navy and its efficiency for granted. In another organisation with which he was associated they had been contemplating a paper on chemical engineering in relation to the construction of the new liner "Queen Mary," and to some extent Commander Bedale's paper seemed to fill the bill. He noticed, however, that there was no reference to the important question of the prevention of fire in ships, from the point of view of rendering wood non-inflammable. Neither was there any reference to the numerous alloys of various kinds which formed part of the construction of most ships.

Corrosion by Sea Water

Mr. J. Harbottle (Lloyds Registry, Glasgow) agreed that the causes of corrosion were controversial, but they might be attributed to chemical, electrolytic or catalytic action. Where one cause started and another ended, or whether they merged into a combined cause it was difficult to say. Rust, rendering the underlying material electro-negative, the first film made the electrolytic cycle complete, apart from any elements composing the material which might be wide apart in electric potential. Impurities met with in different river waters contained magnesium chloride, oxygen and carbonic acid gas as common components. Magnesium chloride would, under certain conditions, split up, giving free hydrochloric acid which would attack plates. The iron attacked formed iron chloride. This split up giving black oxide of iron and acid black again, the corrosion thus forming a cycle. Again, other writers stated that oxygen in the presence of CO_2 attacked rivets and plates, producing ferrous carbonate, and in the presence of water and oxygen this formed ferric hydrate. In contact with iron this was reduced to black ferrous oxide, and oxygen was liberated. The oxygen and carbon dioxide attacked the metal, and thus corrosion was started by an electrolytic and chemical combination. He had had cases of rapid corrosion almost going through boiler plates in four days in new water-tube boilers, the whole of the tubes and screw stays in another boiler corroding away in two months. In this case it would appear to be catalytic action, but so far no one had been able to find a catalyst of Fe. They looked to the chemist to do this. They also looked to the chemist to rid them of dry rot in timbers.

Commander Bedale, replying to the discussion, admitted that he had not made a study of rendering wood less inflammable. The use of alloys was too vast a subject to be discussed in conjunction with the present paper. With regard to corrosion, the chief trouble in the Navy was not internal but external. Soot and rain lodged in places where small tubes were placed close together and it was difficult to clean them adequately, damp soot being a favourable promoter of corrosion.

A vote of thanks was accorded to Commander Bedale on the proposition of the chairman.

Food Transport by Rail and Sea

Papers Read Before the Food Group

In the absence, through illness, of Dr. L. H. Lampitt, Mr. Edwin Thompson presided at a meeting arranged by the Food Group at the Central Station Hotel on Wednesday morning, when papers on the transport of food by sea and rail were presented respectively by Dr. A. J. M. Smith, of Cambridge, and Sir Harold Hartley, of the L.M.S. Railway.

Dr. Smith said the amount of foodstuffs transported by sea was in the neighbourhood of 50 million tons per annum. Wheat represented about a quarter of the total, cereals, as a whole, over a half, and sugar about one-fifth. World trade in meat was much smaller and amounted to about two million tons; in fact, there was more tea, coffee and cocoa transported overseas than there was meat. The share of Great Britain in this trade was unique; she took more than a quarter of the cereals, two-thirds of the beef and nearly all the mutton and pork carried on the high seas.

Having reviewed the historical development of sea transport of foodstuffs, Dr. Smith said that as a result of investigations carried out by the Department of Scientific and Industrial Research a new system of storage of fruit had been introduced which depended upon natural connection. Another ancient problem was the question of ventilation, the condensation of moisture being the source of a great deal of trouble. The adoption of refrigeration had not solved the problem, but had transformed it into a more complicated question. The provision of gas-tight refrigeration space in ships engaged in the Australian trade was now a commonplace, and it should become possible for Australia and New Zealand to export up to one-half of their meat products as against the existing 20 per cent.

The possibilities of gas storage were enormous, but caution was necessary in applying them. Foodstuffs were of all cargoes, the most liable to suffer from tainting and also the most liable to taint each other. Taint was basically a

problem of the kinetics of absorption and diffusion of a vapour. Little was known about it, partly because the nature of the odorous substances was usually unknown, partly because the system which absorbed them was physically so complex and partly because in most cases only a psychological estimate of quantity was possible. The tainting of eggs and butter by oranges had received some attention in the laboratory, but the study of taint might have to wait on the development of that for more fundamental aspect of food science—the chemistry and biology of flavour, which to-day was only in its extreme infancy.

A peculiar problem for the carrier of refrigerated cargoes had been the fact that different cargoes seemed to need different methods of refrigeration. In practice a ship could not in the nature of things carry an independent cooling equipment for each cargo. The equipment must be flexible, and what was needed was an omnibus system suitable for the whole range of cargoes. Vessels which were fruit carriers pure and simple were almost invariably equipped with the battery system, while carriers of chilled and frozen beef were invariably equipped with the grid system. A simple solution of varying cargoes would be to install a battery and grids in each hold, but the cost was almost prohibitive. Various "screened grid" systems had been born of the necessity for a compromise. They offered some of the advantages of both original systems and showed some disadvantages of their own. The striking variability in the design and equipment of the refrigerated space of ships constructed in the last fifteen years was a measure both of the thought devoted to these problems and the step towards a satisfactory solution.

Growing Demand for Refrigerated Transport

Sir HAROLD HARTLEY, in his paper on the transport of foodstuffs by rail, said railway transport besides carrying home-grown food was an essential complement to sea transport for carrying food to the ships and for distributing it on arrival. The railway problem was usually simpler, owing to the shorter times of transit and the bulk of rail-borne food was conveyed without special precautions. In many cases the expense of conditioned transport was avoided even with perishable food by quick service, including collection and delivery, but there was a growing demand for refrigerated transport especially since the limitation of the use of preservatives in this country by the Public Health Regulations of 1927.

The causes of the deterioration of perishable food in transit might be grouped under three headings: (1) chemical changes due mainly to the action of enzymes normally present in the food; (2) changes due to micro-organisms with which the food became contaminated from external sources; and (3) changes in appearance which affected the saleability of the food, such as the loss of bloom of meat. Changes of the last kind were specific to each class of foodstuff and might need special precautions in each case. Humidity was often an important factor; for example, either excess of moisture or excessive dryness of the air would destroy the bloom on meat. Since both the rate of chemical change and the rate of growth of micro-organisms fell rapidly with temperature, it was possible to protect food in transit from deterioration due to the first two causes by keeping it at a temperature at which chemical and bacterial changes were negligible during the journey and by protecting it as far as possible from contamination in suitable wagons or containers.

Five Methods of Cooling

The most important point in the construction of the refrigerated vehicle was the insulation which prevented leakage of heat through the walls so that if the contents were pre-cooled before starting there was only a small temperature rise during transit, or, if refrigerants must be used, the amount and therefore the cost was made as small as possible.

A good deal of work had been done by the scientific research department of the LMS to determine the most economical type of construction for various purposes, and he wished to acknowledge the constant help received from the three research stations at Cambridge, Aberdeen and Ditton, and particularly from Dr. A. J. M. Smith at each stage of the problem.

Five different methods of cooling were used under different circumstances: (1) pre-cooling before loading, (2) use of ice, (3) solid carbon dioxide, (4) eutectic inserts, and (5) small mobile refrigerating plants. The rapid development of refrigerated transport by rail in recent years was a good illustration of the saying that every new facility created new traffic. Not only had research extended enormously the possibilities of transporting perishable foodstuffs, but there had come a growing appreciation of the value of refrigerated transport in reducing wastage and improving the condition in which the food reached the consumer. Both had created fresh demands for the new type of service.

Sir Harold proceeded to describe in detail the experiments that had been made and the success achieved in the transport of meat, fish, milk and fruit, and said that although the main object of his paper was to show the part the railways were taking in the development of refrigerated transport the essential part they played in food transport as a whole must not be forgotten. While in other industries the scientific control of factory conditions enabled production to be placed in its logical position with regard to raw materials or centres of consumption, thus reducing transport, in agricultural local advantages of soil and climate still determined the areas in which production was cheapest or in some cases where alone it was possible, and modern transport enabled the consumer to take advantage of all the variety of diet which nature had to offer. The developments of which he had spoken had a deeper significance than the varied attractions which they offered to the cultured palates of the present generation. Nobody to his knowledge had yet made an estimate of the cost to the nation of the avoidable incidence of individualism, but it must be huge and there was a growing feeling that of the waste and suffering malnutrition was by far the greatest. What were the foods that were necessary to bring the average diet in this country to a standard that was sufficient to sustain full health and efficiency? The answer was more milk, more fresh fruit and vegetables, more dairy produce, more fish and, for many people, more meat, the very foodstuffs, in fact, which refrigerated transport by rail and sea had been designed to carry.

Preventing Deterioration

Dr. R. H. PICKARD said in the somewhat parallel line of research in which he was engaged the problem of containers had given a considerable amount of trouble. A good many fabrics when sent abroad frequently became destroyed through the attacks of micro-organisms. The obvious way of preventing deterioration—by keeping down the moisture content—was impracticable commercially to the necessary extent. Gas storage in tin-lined containers had proved successful in an experimental sense.

Mr. E. GABRIEL JONES (Liverpool) raised the question of bleached pulp, and Dr. Smith said he had no doubt that improvements in gas storage would lead to an improvement in the unsatisfactory condition of sulphite pulp.

Dr. J. SWORD (Glasgow) thanked the authors for their papers and said the choice of the subjects for that session was the outcome of prolonged deliberations on the part of the executive of the Food Group. The whole treatment of the subject of food transport had been very exhaustively treated and the papers were welcome additions to the literature of the Group.

Mr. W. A. S. CALDER afterwards presided at the Food Group luncheon at the Central Station Hotel. There were no speeches beyond the brief proposal of a toast to Dr. Lampitt, and a message was despatched to him expressing the good wishes of the Group for a speedy recovery to health and strength.

State Enterprise in Polish Chemical Industry

ALTHOUGH improved in some branches, the general position of the Polish chemical industry was on the whole unsatisfactory in 1934, particularly in the fertiliser branch. Owing to the important shift in chemical consumption which forced the chemical industry to depend almost wholly on the Government, increasing numbers of manufacturing units are financially controlled by the Government. In 1934 a rather large number of chemical products was made for the first time in Poland. While formerly the initiative in the production of new chemicals was almost wholly credited to factories other than Government owned, in 1934 increasing interest was shown by State enterprises in developing new products.

Letters to the Editor

Report of the Poison Board

SIR,—We think it essential that no time should be lost in drawing attention to the recommendations of the Board in regard to the " prescribed qualifications " relating to the manufacture of preparations containing poison for " the internal treatment of human ailments."

While the report states that the Schedule applies only to the manufacture of medicinal preparations, a glance at the Poisons List will indicate its very wide scope. Any of the substances there listed are, or may become of themselves, medicinal preparations, so that this schedule to the Bill, if ratified, will affect not only the manufacturers of pharmaceuticals, but, directly or indirectly, the whole fine and even perhaps the heavy chemical industry.

The British Association of Chemists, therefore, considers it essential that attention should be drawn to certain statements made in the Report relating to the qualifications required for supervising the manufacture of what the Board calls pharmaceutical preparations containing poison, manufactured for the purpose of the internal treatment of human ailments. It has recommended that supervision of such manufacture should be restricted to four classes of persons: (a) Registered pharmacists; (b) Fellows or Associates of the Institute of Chemistry; (c) duly qualified medical practitioners; (d) persons who have been engaged continuously for three years in the manufacture of pharmaceutical preparations.

No one denies, of course, that restriction of some sort in connection with the manufacture of poisons is necessary, but the recommendations made by the Board, very far from achieving any useful purpose, will actually be an obstacle to the development of chemical industry. Certain statements made in the Report, to which allusion will later be made, indicate quite clearly that the Board lacks adequate knowledge both of the realities of the situation in general and of what constitutes chemical qualifications in particular.

In the first place the Section 27 relating to qualifications is open to grave objection. As laid down, it includes a large number who are certainly not qualified to manufacture poisons and excludes many who are. The registered pharmacist if he has experience of large-scale operations is qualified to supervise; the medical practitioner is not competent to prepare poisons on a manufacturing scale whether they are to be used for internal treatment or not. The last category refers to those who have been engaged in manufacture continuously for three years. While this is perhaps the most practical recommendation it is insufficient in itself.

This, however, is by no means the most unsatisfactory part of the Report. Section 65 (pages 34, 35 and 36) set out the reasons which have influenced the Board in its findings. Some of the statements made cannot be allowed to pass unchallenged. The Board states on page 35 that " There is a further class of persons to be considered. Many chemists obtain their training in chemistry at universities or technical colleges at which they take a degree or a diploma in Science, and they are frequently chemists of high standing. A university degree or diploma in Science does not, however, necessarily imply that the holder is qualified in chemistry."

Of, course it does not; but this statement is nevertheless *suppressio veri* and *suggestio falsi*. Since it alludes to it on the following page, the Board knows that there is such a thing as a degree in science with honours in chemistry. Does it really believe that the holder of such a degree is not qualified in chemistry? Apparently it does. Further, down on page 35, the following remarkable observation is to be found: " We are faced with the fact that there is in this country no recognised body other than the Institute of Chemistry that issues certificates *or other documentary evidence* [the italics are ours] of competency in chemistry as such." This is a gross misrepresentation of fact.

It has further been pointed out to the Board, who have ignored the representation, that the British Association of Chemists issues documentary evidence to its Full Members of competency in chemistry as such. It was further informed that requirements of the Association were at least as high as those of the Institute of Chemistry. Apparently the Board thinks that documentary evidence of competency in chemistry as such must consist in a document which contains those very words or words to that exact effect, a contention so absurd that it seems impossible that any responsible body could entertain it.

The next contention is one of more weight. The Board considers that the restrictions are concerned not only with qualification but with ethics. It points out, correctly, that the Institute of Chemistry, the General Medical Council, and the Pharmaceutical Society have disciplinary powers over their members. But it states with characteristic inaccuracy . . . " the Institute occupies in respect of the chemical profession much the same position in this regard as do the General Medical Council and the Council of the Pharmaceutical Society in respect of the medical and pharmaceutical professions respectively." The Board has ignored the information supplied by the Association that its rules give the Council power to take disciplinary action of exactly the same kind as the bodies named.

The Institute of Chemistry occupies, in fact, no such position. Removal from the medical or pharmaceutical registers makes it impossible for the medical man or the pharmacist to practice his profession. Removal from the register of the Institute of Chemistry has no such statutory force behind it. This question is of considerable importance in view of a further slip which occurs at the top of page 36, where it is stated that " It (the Institute) can withdraw its qualifications in cases of professional misconduct."

This is a gross blunder. No institution can in this way "withdraw its qualifications." All that it can do is to remove the offender's name from its register and with it all rights and privileges, which may include—but which does not include in the case of the Institute of Chemistry—a licence to practice. Qualification is not a right or privilege in this sense. It is conferred absolutely by satisfying examiners or by some equivalent test. A doctor struck off the medical register does not cease to be qualified. He loses the legal right to practice.

These questions are of great importance because they indicate that the Board has made an authorative statement upon which an appendix to an existing Bill will be founded. A vital part of their findings turns upon the question of qualifications and ethics. But it appears that this authority has not grasped the elementary distinction between being qualified to perform certain work and being licenced to do it.

This incomplete knowledge of what really constitutes chemical qualification may have far-reaching effects. It is obvious that highly-qualified chemists and chemical engineers competent to undertake work of this kind will be unable to do so if they are not members of any of the bodies named in the schedule.

Had the Board been prepared to take advice which was really representative of the profession of chemistry its findings would have been different. The societies named, with others, might well have been included. Their function would be to recommend qualified persons whether of their membership or not for work of this kind. Disciplinary action could be taken where necessary for professional misconduct, but, what is equally important, the operation of the Act would be restrictive in a really practical sense. To give one example, as the Act stands a chemical engineer with the diploma of the Institution of Chemical Engineers, who had improved or devised a plant for the large-scale manufacture of a poison might be compelled to transfer the supervision to a medical man with no knowledge of chemical plant whatever because he possessed that priceless attribute " the prescribed qualifications in chemistry," a term of which the original framers of the Act made use, but, perhaps, wisely, did not define.

Now that the Poisons Board has completed its labours we are left with the impression that it has prescribed every kind of qualification except the right one.—Yours faithfully,

HENRY T. F. RHODES,
Editor, " The Chemical Practitioner."
British Association of Chemists,
175 Piccadilly, London, W.1.

The Past, Present and Future

Dr. E. F. Armstrong Delivers the Society's Medal Lecture

Dr. E. F. Armstrong, F.R.S., who received the Society's Medal.

DR. E. F. ARMSTRONG was presented on Thursday morning with the medal of the Society of Chemical Industry "for conspicuous services to chemistry," and afterwards delivered the Medal Lecture, his subject being "The Past, Present and Future."

In the chemical industry, as indeed in all other matters, he said, the past 25 years largely divided itself into the war period and its aftermath. During the former we found ourselves lamentably unprepared and were forced at first to improvise and later to build manufacturing plants on a scale never previously attained; it was undisputed that chemists and the chemical industry came well out of the searching ordeal. During the post-war period it had been for us to take to heart the lessons we had learned, in particular to teach the Government and the people the significance and indispensable importance of a national chemical industry.

The training of the chemist was a perennial subject which had been much discussed and on which we all had views. If he made a contribution to it, based on considerable experience, it would be on the basis that there were many kinds of chemist whose training would differ widely. In the forefront he would put the statement that we only wanted the best men to become chemists, men of ability and knowledge imbued with energy and enthusiasm. Chemistry was a hard mistress to serve; it was not a career for the mediocre. Chemical and physical theory was in a state of involved complexity at the present time; it might be, as had been suggested, that someone would arise who would restore it to order and simplicity again for the help of the student of the future. Simplicity was a great virtue: it was an achievement of genius to arrive at clear expressions of far-reaching truths which involved great complications. To-day we were faced with an ever-growing accumulation of facts which no one brain could hope to master.

Greater Output and More Leisure

Under the world conditions prevailing to-day, the rate of technical progress had been accelerated so rapidly that labour readjustment and re-employment had not kept pace with it, and there was widespread recognition of the wisdom of reducing hours of work on economic as well as on social grounds. The increasing productivity of labour equipped with machinery driven by cheap power and aided by efficient and scientific administration was realised to be the potent force making for rapid increase in the wealth of nations. A general reduction in hours by agreement only became possible given a further upward movement in productivity or, put in another way, if more and more commodities could be produced with less and less labour, a reduction of work and an increase of leisure became possible if not imperative. It was argued, and properly so, that if agreement failed, statutory enforcement of shorter hours would be necessary.

Our choice to-day was between greater output and more leisure. So long as the standards of living even in the richest countries was below the levels which could be regarded as satisfactory, it was necessary to scrutinise carefully schemes for reducing hours. In actual fact we required more work, further efforts, continued technical progress to raise the standard of life sufficiently and to release labour for other necessary work. Arising out of more leisure was the question of its proper use. At first it would serve to give more recreation, better health; ultimately some additional training, more service to the State.

The chemist had been blamed along with the engineer as in part responsible for the present world muddle owing to the fact that invention and production had outstripped consumption and there was unemployment, even starvation, in a land of plenty. Every chemist would repudiate indignantly such accusation; he knew that a constant flow of new industries was the most vitalising factor in modern industry and that without research there was no security in the industrial life of a modern state. It was indeed our neglect of research at one period which allowed the Continent and America to catch up and even go ahead of us industrially, and it was only by the most strenuous work, aided by certain other favourable circumstances, not the least of which had been the political stability which we had enjoyed under the present reign, that we had been able to catch up again.

Organised research with some measure of State assistance or under State guidance was now a feature in Britain. He was not sure whether this should not be regarded as the most important achievement during the reign. No one could forecast in what direction beneficial results were most likely to accrue, but attempts were being made to cover the whole field of national activity. Britain depended so much on her small industries that it was all-important that these should not only be efficient, but virile and progressive. The finance for development of these presented certain well-known difficulties which had been more successfully overcome in certain foreign countries; hence, perhaps, the fact, which should be a most unpalatable one, that most new things come to us from abroad and we had to consent to paying the foreigner a royalty on them.

Small-Scale Industrial Development

He had in mind such problems as the financing of laboratory-scale research and inventions so as to help inventors, the even more difficult financing and securing suitable skilled technical help for small-scale industrial development, the cost of taking out foreign patents so as adequately to protect an invention, and the development of the larger-scale plant up to the stage of industrial production. Nowadays new inventions cost so much more to work out than they did in the past that the customary method of finding funds from a small private syndicate usually resulted in the money being exhausted when the project had begun to appear feasible. At this stage it was of no interest to the banks or to the city financier concerned only with the profits of a public flotation.

Speaking of the future, Dr. Armstrong said it was at least certain that we could not stand still; that the progress made

in the laboratories, the increase in the number of chemists and the better training they had received would mean substantial progress. To-day, oil refining had become a highly scientific operation, the plants were elaborate pieces of chemical apparatus conceived on an heroic scale. National exigencies were bringing about the erection of refineries, even in countries with no natural oil supplies, so that their crude oil had to be imported. Even in England we were studying the prospects of finding oil, and the quest would be facilitated by the new British regulations which allowed the search for oil and the production of any oil obtained to be carried out under conditions better than those of the United States. The matter was a vital one, the geological problem difficult and involved. Whatever might be the world economic aspect of such plants, he thought we should welcome them as bringing this new designing and operating technique within our midst, so that it could be studied at first hand and applied elsewhere.

Increased Production by Continuous Operation

Our world had many climes, some suited for the production of one natural product which was further worked up or needed by others. Were we all one people, international in outlook, each would produce according to its ability and free transport would do the rest. Instead, we were national, becoming intensively so with problems of defence, exchange and the urge to produce at home. Hence the opportunity for the chemist. In reality he had only just begun to work in this sphere. It was becoming apparent that where he was successful in replacing natural products, the new materials could be made eventually as cheaply or even more so, in greater variety, of more regular quality and independently of the vagaries of good and bad seasons.

The discovery of rayon had had profound social consequences: the replacement of cotton was near at hand. Synthetic rubber would follow. Nitrates could be taken from the air. Coal and water or carbon and hydrogen were providing solvents, motive oils, and the ever-increasing range of useful and essential products known to all. There was going to be no end to the range of possibilities: whenever the team of chemist and engineer really turned their hands to the plough, large-scale production at new low costs, permitting a large extension of the use of the product, would be within reach.

The increased production resulting from continuous operation brought with it the need for an increased outlet for the product which could only be met as a rule by finding new uses. The urge to find these was great in relation to organic substances to-day, and all sorts of out-of-the-way products were being studied and tested in every possible manner, it being assumed, and rightly, that they could be made in quantity if desired. So far, America had taken the lead in studying these new applications, no doubt because of the national willingness of the American to try something new because it was new and to finance it, whereas in Britain our conservatism made it difficult to find the money for new inventions except at exorbitant rates, the profit going into the hands of financiers who took no further interest in the success or failure of the venture. It was as well to stress the condition, as in our belief it afforded an explanation why British chemists were seldom associated with novelties: it was only when they had been worked out abroad and proven that they were adopted here at the cost of a royalty to the foreigner.

The Opportunity of the Chemist

The chemist continued to replace the natural colours by products which surpassed them in utility and brilliance and to add new medicinals to the natural drugs; synthetic vitamins and hormones were but round the corner and chemical therapy would effect an increase in the allotted span of healthy life. We might even unveil the chemical specificity which underlay morphological specificity and made us what we are. Whilst we sought to manufacture so much within our boundaries and limit imports, the chemical study of cold storage and the practice of long-distance transportation was bringing the meats and the fruits of the earth in prime condition to our doors largely from our Empire. Lastly, the achievements in canning would make the town dweller largely independent of crop failures and safeguard his health. A pleasing vision, the rate of its accomplishment would depend on the extent to which the chemist was allowed to co-operate, on the recognition given to the technical men.

The future concerned us all far more than the past or the present: these counted in so far as the experience gained qualifies us to make the best provision for the future. It was a time for planning wisely and well. Cheap money gave the industrialist the opportunity to extend or modernise his plant; now was the time to introduce new methods or economies into the manufacturing processes. Chemists now had their opportunity as never before.

The Annual Dinner of the Society

THE annual dinner of the Society of Chemical Industry was held at the Central Station Hotel, Glasgow, on Wednesday evening. Mr. Edwin Thompson, president, was in the chair, and the principal guests included the Lord Provost (Sir Alexander B. Swan) and Lady Swan, Professor N. V. Sidgwick, president of the Chemical Society, Professor H. E. Armstrong, Mr. W. A. S. Calder, president-elect, Mr. T. Donaldson (chairman of the Glasgow Section) and Mrs. Donaldson, Sir Harold Hartley, Professor G. G. Henderson, Sir A. and Lady Huddleston, Sir James and Lady Lithgow, Sir Robert Rait, Sir Alexander and Lady Walker, the Hon. J. K. Weir, Mr. A. Lindsay Forster, Dr. James Morton, Dr. and Mrs. R. H. Pickard, Dr. and Mrs. R. Robertson, Dr. and Mrs. H. J. Hodsman, and Mr. and Mrs. J. Craig. The speeches were followed by dancing.

Professor N. V. SIDGWICK, president of the Chemical Society, proposed the toast of the Society of Chemical Industry, and said that every member of the Chemical Society, of which he was president, as well as every member of the Society of Chemical Industry, realised the importance of being in close touch with each other. The pure chemists realised the importance of industrial chemistry, not only because of the various ways in which the industrial chemists ameliorated the conditions of life and the extraordinary manner in which they facilitated researches by providing the pure chemists on quite reasonable terms with the materials they needed, but also because the industrial chemists were among their best customers. There had been a great deal of talk as to whether it was possible to bring about closer co-operation between the three principal chemical organisations. There were some people who were opposed to the suggestion on the ground that one or other of the societies might get too great a measure of control over the others. However, they had arrived at a scheme of co-operation which was now practically in force, and it had the great advantage that, while it did not go as far as some of them might wish, it afforded an admirable opportunity of testing the possibilities of co-operation and seeing how well it would work. Personally he did not fear the danger of the subordination of one society by another.

The PRESIDENT, in response, spoke of the importance of the chemist at every point in human life, and said the chemist did not advertise himself enough. A little judicious advertising was not out of place at times. He had attended the opening of the new Chemistry House in France, and he was impressed with the way in which the French had stolen a march over the British chemist in that respect. It was a magnificent building, and surely the time had come when they in Great Britain could at least have a home of science in London. He had on a previous occasion thrown out the suggestion that Burlington House would be an admirable site and he reiterated that it would be a wonderful thing to have in the heart of London a really worthy home of British science. The President went on to suggest an improvement in the constitution of the Society, whereby a greater degree of continuity of service could be secured. He thought it would be well if the affairs of the Society were managed by a small executive, which would report periodically to the Council.

The PRESIDENT next proposed the toast of the Lord Provost of Glasgow, to which Sir ALEXANDER SWAN responded.

Mr. T. DONALDSON proposed the toast of the guests, and Mr. A. LINDSAY FORSTER responded.

Mr. W. A. S. CALDER, president-elect, proposed the toast of the Chairman, and the speeches concluded with a breezy response by Mr. Thompson.

West of Scotland Industries

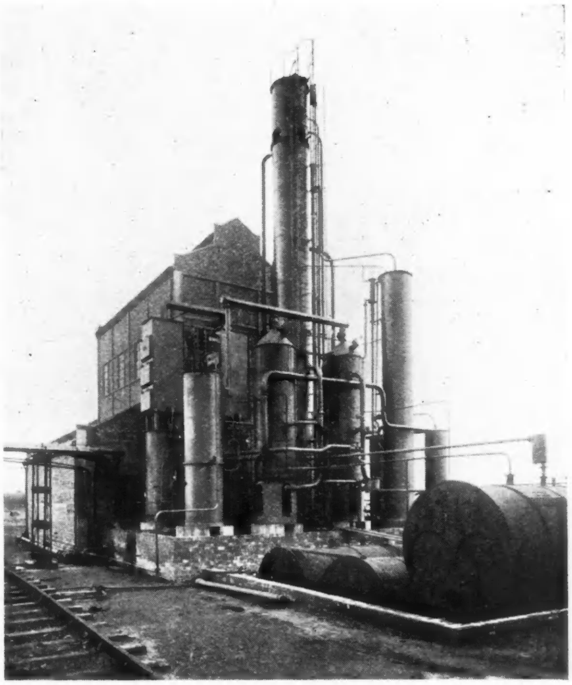
A Look Round Glasgow and District

GLASGOW and the West of Scotland has had plenty to offer its visitors attending the annual meeting of the Society of Chemical Industry this week in the way of industrial interest. Glasgow itself is one of the greatest industrial centres and ports in the British Empire, and exports an infinite variety of industrial products to all parts of the world. Important developments have taken place during the past few years, particularly in regard to the lighter forms of industry. A number of new industries have been established and the manufacture of a considerable number of new products has been undertaken by firms already established in the district. Organised visits have been paid by members of the Society of Chemical Industry during the week to the works of Scottish Oils, Ltd., the steelworks of Colvilles, Ltd., at Clydebridge, the glass silk works of Chance Brothers, and Co., Ltd., at Firhill, the Glasgow Corporation Chemical Works at Provan, the stoneware works of Shanks, Ltd., at Barrhead, the bakeries of William Beattie, Ltd., and City Bakeries, Ltd., while to-day (Saturday) a party is due to visit the Ardeer explosives factory of Imperial Chemical Industries, Ltd. Notes on some of the works are given below.

Glass Silk for Heat Insulation

ONE of the most promising of the new industries that have been set up in the Glasgow district in the last year or two is the manufacture of spun glass, or glass silk, at the Firhill factory of Chance Brothers and Co., Ltd. This glass silk is supplied for the heat insulation of boilers, pipes, tanks, ducts, etc. With the tendency in modern steam-engineering practice towards higher pressures and temperatures, increasing attention has been given to the problem of obtaining efficient and reliable systems of heat insulation. According to some authorities, methods of insulation which were applicable some years ago are not adequate for the rigorous conditions to which pressure vessels are subjected nowadays. New principles and new applications have therefore been called for, and, in the light of the success already obtained by this new method of insulation, glass silk seems to be filling the bill.

Interior of Glass Silk Factory, Chance Brothers & Co., Ltd., Firhill, Glasgow.



Dephenolating Plant, Provan Works, Glasgow Corporation Chemical Works Department.

Glass silk, as its name suggests, is composed of very fine threads of glass which closely resemble silk in appearance. The threads possess a surprisingly high tensile strength, and when spread into the various forms suitable for heat insulation produce a network of fibres highly resistant to vibratory influences, which is such an important consideration in engineering practice, particularly marine work.

While still air has long been known to form an almost perfect heat insulator, it is obviously impossible in practice to take advantage of the solution which the apparent simplicity of this fact may suggest. Means must be found to imprison the air in such a matter that under changing temperature conditions it will remain stationary for all practical purposes. As regards diatomaceous earths and other similar porous substances, advantage is taken of the minute air cells which constitute the pores in their structure, and in order to bind the materials together for the purposes of practical application fibrous substances are added. This introduction of extraneous matter, which in itself possesses relatively low powers of resistance to heat flow, detracts considerably from the efficiency of the whole. It is claimed that glass silk, with its long, fine silken fibres, offers a solution. The air cells are imprisoned between the threads, which when spread into the various suitable forms lie closely together, and since they can be stitched and possess a natural tendency to cling together in network formation the addition of binding materials is quite unnecessary.

Glass silk is quite incombustible, and is guaranteed to withstand temperatures as high as 900° F. In fact, it has been tested and proved up to a temperature as high as 1,100° F. Being glass, and nothing but glass, it is rotproof, and offers no sustenance to vermin and neither causes corrosion nor is attacked by any chemical, with the exception of hydrofluoric acid.

Glasgow Corporation Chemical Works

THE Glasgow Corporation Chemical Works, at Provan, are under the control of the gas department. Since the department took them over in 1920 the works have been reorganised and extended to deal with the increased quantity of crude tar and ammonia liquor from Provan gasworks, and also the distillation products from the department's works at Dawsholm, Dalmarnock and Tradeston.

The liquid by-products are received from the Provan gasworks by pipe-line and discharged into an underground well. Into this well also are received the rail tanks of crude con-

centrated liquor produced at the three other works. After a short period for settling, the ammonia liquor is pumped through a dephenolating plant where the phenols are extracted and treated in the carbolic plant. Up to 1930, no plant existed for removing the tar acids from the spent liquor, but in that year Holmes, of Huddersfield, built the first dephenolating plant for Manchester Corporation—the first plant of this kind in Great Britain. After due consideration, a similar plant, but of larger capacity, was erected at Provan Chemical Works, and is the second of its kind n this country.

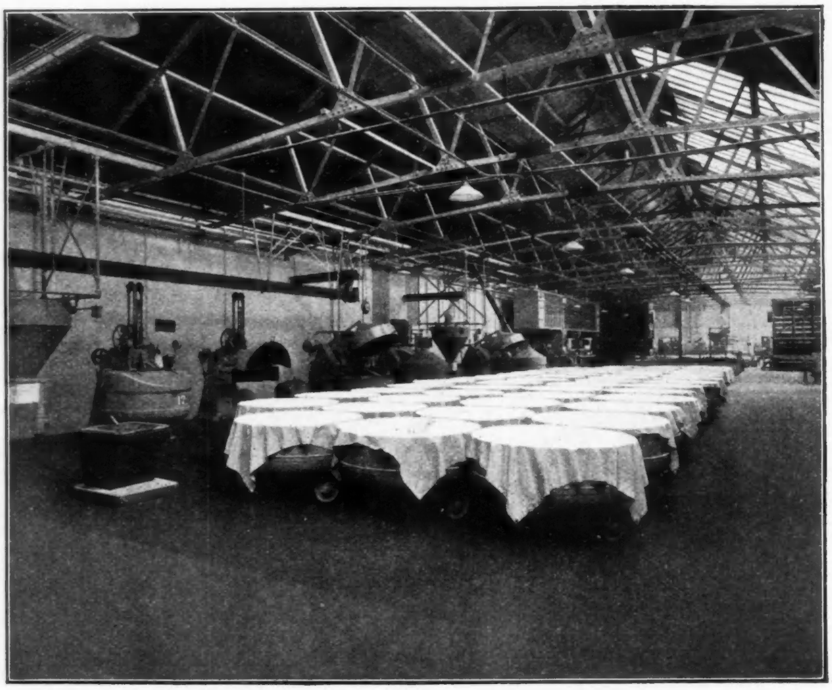
The ammonia plant was originally designed for the manufacture of sulphate of ammonia by Ernest Scott and Co., Ltd. There are two units, each having a capacity of 70,000 gal. of ammoniacal liquor of 1 per cent. strength per 24 hours; equivalent to 12.5 tons of sulphate of ammonia. With the stronger liquor the present daily production is much greater. All pumps on this plant are steam driven and the exhaust steam goes direct to the stills. The plant is so designed that the various units are interchangeable.

The sulphate plate has been adapted for the manufacture of liquor ammoniæ, and may rapidly be turned into use for this purpose. One of the stills functions as a decarbonating tower and the other as a finishing still. The purified ammonia gas is absorbed in four receivers charged with town water. The capacity of the plant working the liquor ammoniæ is 33 tons of 25 per cent. solution for 24 hours. The stills are automatically controlled by Arca temperature regulators.

In the tar stills section the crude tar is pumped from the underground well to three main storage tanks, having a total capacity of 1,625,000 gal., for further settling. Originally the whole bulk of the tar in each storage tank required to be heated to raise the temperature sufficiently for pumping. By installing a small heater adjacent to the main storage tank, only the amount of tar necessary for immediate use requires to be heated. This arrangement has resulted in a large saving of steam. Coke breeze is the only fuel used at the stills.

Other plant at the Provan Chemical Works includes a continuous "Dorr" system caustic soda plant, a triple-effect evaporator, carbonators, a battery of three 11 ft. diameter acid stills of the pot type, a Wilton "stripping" plant, two benzole washers of 3,000 gal. capacity, and a pyridine plant, including towers for decomposing and dehydrating alongside a still complete with fractionating column, condenser and finished product storage.

All drainage from the works passes through a Knight and Smith separator, which removes all oil which will separate out. For steam raising there are five Babcock and Wilcox water-tube boilers. Three are fitted with electrically-driven chain-grate stokers and two with steam-driven underfed stokers. All the five boilers are fitted with superheaters. The fuel used is entirely low-grade coke breeze, the plant being both dustless and smokeless. A steam accumulator having a capacity of 10,000 lb. steam at a pressure of 120 lb. discharging down to 30 lb. allows for any peak loads that take place and enables the works to be supplied with steam for a considerable period should plant shut down at any time.



A Battery of Dough Mixers at the Dennistoun Bakery of William Beattie, Ltd.

Bread of Seventy-Nine Varieties

At the Dennistoun Bakery of William Beattie, Ltd., in Glasgow, 79 varieties of bread are now made, 45 varieties being white and the remainder brown, with one exception—the "twin loaf"—which is half brown and half white. It has always been the aim of this firm (established 1876) to supply bread to suit all tastes, and recently more attention has been paid to the dietetic value of the bread, and loaves have been produced in accordance with current dietetic theory. Barm, yeast and Chemical aeration are all used in the production of the bread.

The so-called Parisian barm is a very old-fashioned method of yeast growth which has been retained in this factory becauuse it is believed that by its use it is possible to obtain better flavour and keeping qualities in the loaf. A solution of irradiated ergosterol in arachis oil is added to barm-raised batch bread, giving a guaranteed potency of 0.5 international unit of vitamin D per gram as proven by biological assay. This batch loaf was selected for the addition of vitamin D in order that the maximum benefit of the addition might be given to the largest consumers of bread. Bread containing 10 per cent. or $22\frac{1}{2}$ per cent. of Soyolk (soya flour) is produced for high protein, reduced carbohydrates or alkaline diets. Two types of diabetic bread are made—carbohydrate-free or carbohydrate-reduced; another bread, completely free from sodium chloride, is made for cases of nephritis, etc. Proprietary flours, such as Hovis, Allinson, Darto, Turog, Veda, etc., are also baked. Brown bread is prepared from

Making Crumpets on a Hotplate at The City Bakeries, Ltd.

100 per cent. stone milled wheatmeal and this in all proportions with white flour, malt, added bran, etc. In addition, a large variety of sponge goods, oatcakes, hand-made biscuits, etc., amounting to some 400 lines are in daily production. "Carntina" dog foods, including rusks and biscuits, were inaugurated a few years ago in response to the demand for feeding stuff which would not cause hysteria. In addition, a whelping rusk is produced; this contains vitamin "E" in large proportion, which has been of great value to breeders.

Another Progressive Bakery

It is less than thirty years since the late Mr. Robert Urie, a Glasgow baker, founded the City Bakeries, which now have over sixty branches throughout Glasgow and district. The beginning was small and unpretentious but this bakery has been enlarged many times, until to-day it is seven storeys high. Gas and electric ovens are extensively used; cakes, pies and biscuits pass into these in their raw state to emerge crisp and perfectly fired with absolute uniformity. The task of coping with the immense demand for such a very large variety of products is carried out by highly-trained craftsmen and their assistants. Every department is under the expert supervision of a specialist in his trade. Only the finest ingredients, purchased in the world's best markets, are employed, and all are carefully examined before use.

Recognising that quality in goods demanded quality in service, the City Bakeries were among the pioneers in staff training. In the lecture room at headquarters every girl joining the selling staff undergoes a course of training in the art of selling before she is permitted to serve in a City Bakeries shop. Staff welfare is also constantly considered by the management, for this fosters a fine spirit of co-operation among the staff, and goes far towards maintaining the high standard of health enjoyed by the employees—a most important feature of a bakery establishment.

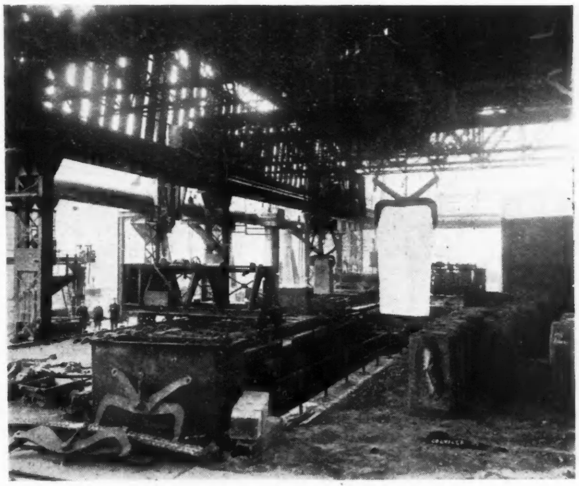
Iron and Steel Manufacture

The iron and steel industries in Scotland are indissolubly associated with Colvilles, Ltd., the history of the one being in part the history of the other. During a period of 150 years, units of the company have been prominently connected with pioneering developments in the manufacture of iron and steel, and, to-day, the company is still in the forefront in the development and production of various kinds of iron and steel for commercial purposes.

Colvilles, Ltd., owes its inception to the late Mr. David Colville, senr., who, in 1871, founded at Motherwell, Scotland, the Dalzell Iron Works. This concern made steady progress, and early recorded notable successes. Steelmaking was begun in 1880, "Dalzell" steel speedily established a wide reputation for high quality, and Dalzell Works, prior to the great war, had grown to be the largest individual steel works in the country. The exigencies of the war necessitated the acquisition of two other large steel works which, modernised, now incorporate plant eminently capable of supplying the demands of present-day advanced engineering. In addition, a controlling interest was obtained in a group of other concerns, including coal mines, limestone quarries, foundries, alloy steel works, sheet and galvanising works. Significant of the tendency towards the rationalisation of the steel industry of this country was the recent amalgamation of David Colville and Sons, Ltd., with the steel works and blast furnace units of another well-known company, *viz.*, James Dunlop and Co., Ltd. (founded 1786)—the new combination being designated Colvilles, Ltd. The present annual capacity of the company is over 1,000,000 tons steel ingots.

As befits the renown of the company's steels, the works of Colvilles, Ltd., are scientifically organised and adequately equipped to deal with all phases of engineering activity. At the Dalzell Steel and Iron Works, Motherwell, are manufactured boiler, ship, bridge, tank and locomotive plates, standard and special sections to all requirements, rounds, squares, blooms and tube billets, and numerous special steels, while the company's Clydebridge steel works specialise in steel plates for ship, bridge and tank building. In the works at Clydebridge there is one of the finest plate-producing plants in the world, the electrically-driven three-high plate-rolling mill holding a world's record for output. The Glengarnock works are engaged in making bars, rails and sections.

The Clydebridge Steel Works are equipped for an output of over 5,000 tons of plates per week, and, so far as the new portion of the works is concerned, represent the latest methods in steel works practice. The works were opened in 1888 by the Clydebridge Steel Co., Ltd. The original plant comprised six acid-lined open-hearth furnaces and a battery of gas producers, the nominal capacity of each furnace being 25 tons. Ingot reheating furnaces and a slab cogging mill were installed, and the further plant included a geared slab shearing machine, slab reheating furnaces, and two reversing plate mills, with the necessary equipment of plate shears and other auxiliary plant. All the machinery was steam-driven by non-condensing engines, the steam being raised in a battery of Lancashire boilers. In the year 1907 a further addition of two 50-ton acid-lined open-hearth furnaces was made and another heavy plate mill was installed.



Ingot Reheating Furnace, with cover lifting crane at the Clydebridge Iron & Steel Works of Colvilles, Ltd.

In the years immediately preceding the war there was a serious depression in the Scottish steel trade, and for some time the works were completely shut down. In 1914 they were still closed, but with the outbreak of hostilities there was a sudden demand for steel billets capable of rapid conversion into high explosive shells of various sizes. Several Scottish steel makers were approached by the Government authorities with a view to meeting this urgent demand, and, at the urgent request of the Government, David Colville and Sons, Ltd., purchased the Clydebridge works and made the necessary alterations for producing billets of the desired sizes.

At the present works the five open-hearth furnaces in the melting shop each have a nominal capacity of 60 tons. The furnaces are served by two revolving open-hearth charging machines of the overhead type, made by Babcock and Wilcox, Ltd., so arranged that the charging boxes may be taken up from the marshalling and stock bay and their contents delivered to the furnaces. This bay is served by two 10-ton magnet cranes made by John Grieve and Co., which lift the scrap and pig iron either from the stock piles or straight from the wagons and deliver it into the charging machine boxes. On the other side of the furnaces there are two special 100-ton overhead cranes supplied by Sir William Arrol and Co., Ltd., for transporting the ladles from the furnaces to the ingot moulds.

The gas for firing the open-hearth furnaces and for supplying the ingot reheating furnaces is generated in a battery of fifteen gas producers of the water-sealed type adjoining the stock bay. These producers are fed with Lanarkshire coal.

After the ingots have cooled sufficiently they are stripped from the moulds by one of two 12-ton cranes. After stripping, the ingots are transferred to a battery of dead soakers which are situated in the casting bay at the entrance to the cogging mill bay. When the furnace plant is in full operation the stored heat in this series of soaking pits is sufficient to keep the ingots at a high temperature until they are ready to be charged into the re-heating furnaces.

Waste heat boilers are of the Babcock-Wilcox water-tube type, and there is one for each melting furnace. In series with each boiler there is also a Green economiser. The

passage through the boiler and economiser cools down the furnace gases to 171.5° C., and it becomes necessary to employ an induced draught fan in order to maintain the necessary draught at the furnaces. The fans, by Keith and Blackman, are of the multi-vane type.

Agricultural and Dairy Research

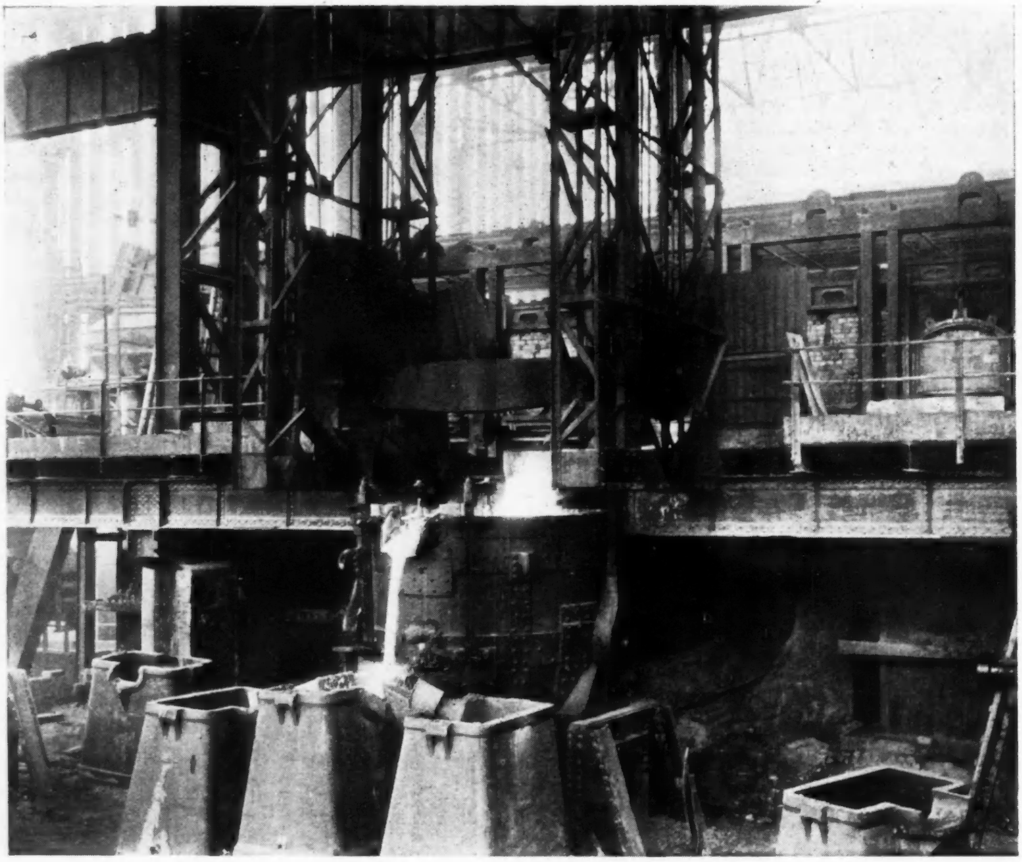
THE farm lands of Auchincruive were gifted to the West of Scotland Agricultural College in 1928. They are situated in an agricultural district three miles or thereby from the town of Ayr. The farm, which is suitable for mixed arable and dairy husbandry, extends in all to 660 acres, of which 185 acres are under cultivation. The principal crops grown are oats, turnips and swedes, early and maincrop potatoes, ryegrass and clover hay and silage crops. Besides supplying the necessary feeding for the college herd of dairy cows, bullocks and work horses, certain sections of the arable land are available for large-scale experimental work, such as the comparison of varieties of oats or of different grass seed mixtures, while certain areas are definitely allocated for demonstration purposes and research work.

The dairy school embodies all the features essential for the training of students in dairying, and is equipped to meet the requirements of the factory as well as the farm. The buildings are divided into three sections : (*a*) milk processing, for the manufacture of condensed milk and crustless cheese; with mechanical equipment for washing and sterilising milk cans, pipes and bottles; (*b*) cheese-making, small vats being installed to provide greater facilities for individual instruction; (*c*) butter-making, with separating, butter-making and ripening rooms, and small cold store and attached ice cream freezer conservatory.

There are two bacteriological laboratories; the main laboratory being fitted up primarily for tutorial purposes, but also for milk testing and research work. Facilities are given to students to acquire practical experience of the testing of water and milk for purity, the isolation, cultivation and testing of starters, and examination of butter, cheese and dairy produce. In the smaller laboratory are prepared the media used for cultivating bacteria and in the examination of milk samples. Two chemical laboratories have been provided, the larger of which is used for biological research, and for the physical and chemical investigation of milk products. Facilities are provided for research and senior students specialising in biochemistry, with special reference to agriculture and dairying.

The section of the estate devoted to the poultry school covers about 20 acres. Various nutritional experiments in growth and laying are undertaken. The bee-keeping department is equipped to instruct students, investigate bee problems and give every assistance to the bee-keeping industry.

Problems connected with the feeding, breeding and management of dairy cattle are studied in connection with milk production. Considerable attention is given to the provision and utilisation of home-grown roughages, such as roots, silage, beet pulp, hay and straw. The concentrates are also being studied with a view to determining the best method of utilising home-grown grain on dairy farms, and the most suitable concentrate to purchase for the balancing of home-grown feeds. The "Colin Thomson Laboratories" have been designed for the study of problems relating to milk and its manufactured products. Laboratories have been provided where investigational and experimental work on milk processing, butter and cheese can be carried out under controlled conditions. There is also a refrigerating room in which the reactions of milk and its products under cold storage conditions can be studied. An important feature of the design is the starter preparing room, a compartment reserved for the propagation of pure culture starter used in the butter and in the cheese industry.



Tapping Platform, showing 70-ton ladle and crane, at the Clydebridge Iron and Steel Works of Colvilles, Ltd.

News from the Allied Industries

Artificial Silk

THE CANADIAN CELANESE COMPANY is planning an expansion of plant operations in order to catch up with deliveries, which have fallen behind. Originally the directors intended to finance expansion by issuing to shareholders the remaining 49,591 common shares in the treasury, but it is now understood they will finance out of earnings, which are reported to be running at better than $4 a share. The possibility of a common dividend of $1.50 a share is mentioned. No dividend has yet been paid on the $250,409 common share capital.

Sugar

BOTH CONSUMPTION AND PRODUCTION OF SUGAR in eleven European countries showed an increase during the eight months September 1, 1934, to April 30, 1935, compared with the corresponding period of 1933-34. Consumption amounted to 4,477,746 long tons, raw sugar value, an increase of 78,523 tons, or 1.8 per cent., compared with the corresponding period of 1933-34. Production, which amounuted to 5,664,187 tons, was an increase of 922,485 tons, or 19.5 per cent., more than the amount of sugar produced during the same period of 1933-34.

Shellac

CONSIDERABLE RESEARCH WORK is reported from Ranchi, in the province of Bihar and Orissa, where the Indian Lac Research Association is carrying on its activities. Biochemical research on such subjects as the correct times and methods of pruning lac hosts, the determination of the effect of fertilisers on lac hosts and the testing of little-known host trees, have been successfully carried out. Improved methods of cultivation based on a complete investigation of the life cycle of the insects have also been worked out, and control methods against both insect enemies of lac and of the trees on which it is grown have been devised. The Physico-Chemical Department is examining methods of shellac manufacture, and a number of changes have been devised to produce high-quality lac with special properties.

Continental Chemical Notes

Czecho-Slovakia

THE CHROME ALUM CARTEL between Dynamit Nobel, Nestomitzer Solvay and Joh. Dav. Starck has been extended till May 31, 1936.

France

THALLIUM SALTS PRODUCTION by the Vieille Montagne Co., according to the report for 1934, amounted to 936 tons. Among the other products manufactured by this firm (with annual outputs) were zinc white (20,000 tons), sulphuric acid (160,000 tons), copper sulphate (13,000 tons), fine silver (31,000 tons), and cadmium (226 tons).

Lithuania

ACCORDING TO A KOVNO REPORT a Danish firm has secured the concession for erecting a laboratory for the production of insulin.

THE STATE RESIN PRODUCTS FACTORY will commence production at the end of this year at Olita in Southern Lithuania where about 75,000 pine trees are now in growth, each of which is expected to yield 1.68 kg. crude resin.

Poland

A MANGANESE ORE DEPOSIT has been located in Southern Galicia but transport difficulties render it questionable whether profitable working could be achieved at present.

THE NEW FERTILISER introduced in 1934 under the name of "Kalimag" has been favourably received by the agricultural industries and it is therefore proposed to embark upon a considerable extension of production. Composed of 34 per cent. potassium sulphate (*i.e.*, 18 per cent. K_2O), 54 per cent. magnesium sulphate, 6 per cent. insoluble matter and 3 per cent. or less sodium chloride, it is particularly suitable for tobacco, green vegetables, fruit and potatoes.

Italy

MERCURY IS BEING PRODUCED on a considerably increased scale, the 219 tons extracted in the first quarter of 1935 comparing with only 96 tons in the corresponding quarter of 1934.

INCREASED COPPER SULPHATE PRODUCTION is announced, the output of the 16 Italian manufacturers during the first quarter of 1935 amounting to 50,200 tons, as compared with 44,200 tons in the corresponding quarter of 1934.

Belgium

FOLLOWING CAPITAL REORGANISATION of the Union Chimique Belge, the new capital of 127.50 million francs is divided into 250,000 shares of 500 francs each. Under the new scheme the annual charges on the capital only amounts to about 5 million francs, as compared with 26 million francs in 1934 and 27 million francs in 1933.

Esthonia

THE STATE SHALE FACTORY in Esthonia is being enlarged owing to the continued increased demand for crude oil.

DURING RECENT YEARS casein artificial horn has been produced in Esthonia more and more on the basis of native casein. The requirements of the home comb and button factories are entirely satisfied and the industry is actually in a position to export refined casein.

Switzerland

THE LONZA ELECTRICITY WORKS and Chemical Factories, of Basle, announces a net profit of 134,000 francs for 1934 (against a loss of 723,000 francs) which is carried forward.

THE BAUXIT TRUST A.G., of Zurich, achieved a profit of 300,000 francs in 1934 and proposes to distribute a dividend of 1.20 francs per franc share upon the share capital of 11 million francs.

Personal Notes

MR. ARTHUR M. MATTHEWS, who, until 18 months ago, was the representative of W. J. Bush and Co., Ltd., for the Midlands and Eastern Counties, died on May 30. He joined the firm in 1896, retiring in October, 1933.

MR. EDGAR ROBERTS BROWN, of Warwick Park, Honicknowle, who died last week at Great Missenden, Bucks, was buried at Plymouth on June 29. He was 53 years of age and was managing director of Lomas Gelatine Works, Ltd., and a director of British Glues and Chemicals, Ltd.

SIR JAMES WALKER, of 5 Wester Coates Road, Edinburgh, professor of chemistry in Edinburgh University from 1908 to 1928, and formerly professor of chemistry in Dundee, who died on May 6 last, left personal estate in Great Britain valued at £34,070.

MR. FRANK BEDDING, of W. J. Bush and Co., died on June 18. Mr. Bedding joined the staff in 1903 and was appointed as representative for Ireland and North Lancashire in 1914. In 1923 he was appointed to the Yorkshire and North of England territory in succession to the late Mr. Budge.

LORD RUTHERFORD, EMERITUS PROFESSOR WILLIAM STROUD and PROFESSOR HARVEY CUSHING were the recipients of the degree of D.Sc. at the University of Leeds on Monday. Professor Whiddington, presenting Lord Rutherford, said that of all the names which had come to the fore in physical science in the last few decades that of Rutherford was the most notable. His scientific career had exemplified most vividly the success of a scientific man who, realising the danger of too abstract generalisation, preferred rather to rely on controlled experiment to discover and describe some of Nature's innermost secrets. His earliest work had been in connection with Hertzian waves. In 1911 he had been responsible for the great achievement of discovering the main feature of atomic architecture, the existence of a central small nucleus and a surrounding swarm of satellite electrons. He was the first to show, in 1919, that atomic bombardment by fast hydrogen nuclei, or protons, resulted sometimes in transmutation, and in other cases in the liberating of atomic energy.

Weekly Prices of British Chemical Products

Review of Current Market Conditions

Price Changes

General Chemicals.—CARBON BISULPHITE, £31 to £33 per ton; POTASH, CAUSTIC (Manchester), £38 to £40 per ton; POTASSIUM CHLORATE (Manchester), £38 to £40 per ton; SODIUM ACETATE (Scotland), £20 15s. per ton; SULPHATE OF COPPER (Manchester), £14 5s. per ton.

Coal Tar Products.—ACID, CARBOLIC, crystals, 6¾d. to 8¼d. per lb.; CREOSOTE, B.S.I. Specification, 6d. per gal.; PITCH, medium soft, 35s. per ton, (Manchester), 32s. to 34s.

All other prices remain unchanged.

THERE are few price changes to report in the markets for general heavy chemicals, wood distillation products, pharmaceutical and phitographic materials, perfumery chemicals, essential oils and intermediates. Unless otherwise stated the prices below cover fair quantities net and naked at sellers' works.

MANCHESTER.—Holiday influences are beginning to make themselves felt on the Manchester chemical market, and this is affecting not only new business but also deliveries against contracts of both textile chemicals and of general products. This seasonal recession is likely to continue with increasing force until about the end of next month. In the meantime, buying during the past week has included a numbr of replacement contracts for delivery during the third quarter, and, in some instances, up to the end of the year, although the bulk of the moderate aggregate business put through since last report has been in respect of prompt or near dlivery positions. Apart from the seasonal factor referred to specifications have been reasonably satisfactory and here and there a tendency reported of users' requirements expanding slightly. The market as a whole continues steady, but, as before, some of the by-products are tending towards still lower levels.

SCOTLAND.—Business in chemicals in Scotland has been rather quiet during the week both for home trade and export, but prices continue very steady at about previous figures with only slight changes to report.

General Chemicals

ACETONE.—LONDON: £65 to £68 per ton; SCOTLAND: £66 to £68 ex wharf, according to quantity.

ACID, ACETIC.—Tech. 80%, £38 5s. to £40 5s.; pure 80%, £39 5s.; tech, 40%, £20 5s. to £21 15s.; tech., 60%, £28 10s. to £30 10s. LONDON: Tech., 80%, £38 5s. to £40 5s.; pure 80%, £39 5s. to £41 5s.; tech., 40%, £20 5s. to £22 5s.; tech., 60%, £29 5s. to £31 5s. SCOTLAND: Glacial 98/100%, £48 to £52; pure 80%, £39 5s.; tech. 80%, £38 5s. d/d buyers' premises Great Britain. MANCHESTER: 80%, commercial, £39; tech. glacial, £52.

ACID, BORIC.—Commercial granulated, £25 10s. per ton; crystal, £26 10s.; powdered, £27 10s.; extra finely powdered, £29 10s. packed in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. SCOTLAND: Crystals £26 10s.; powder, £27 10s.

ACID, CHROMIC.—10½d. per lb., less 5%, d/d U.K.

ACID, CITRIC.—11¾d. per lb., less 5%. MANCHESTER: 11¾d. SCOTLAND: 11¾d.

ACID, CRESYLIC.—97/99%, 1s. 8d. to 1s. 9d. per gal.; 98/100%, 2s. to 2s. 2d.

ACID, FORMIC.—LONDON: £40 to £45 per ton.

ACID, HYDROCHLORIC.—Spot, 4s. to 6s. carboy d/d according to purity, strength and locality. SCOTLAND: Arsenical quality, 4s.; dearsenicated, 5s. ex works full wagon loads.

ACID, LACTIC.—LANCASHIRE: Dark tech., 50% by vol., £24 10s. per ton; 50% by weight, £28 10s.; 80% by weight, £48; pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £53; edible, 50% by vol., £41. One-ton lots ex works, barrels free.

ACID, NITRIC.—80° Tw. spot, £18 to £25 per ton makers' works, SCOTLAND: 80°, £24 ex station full truck loads.

ACID, OXALIC.—LONDON: £47 17s. 6d. to £57 10s. per ton, according to packages and position. SCOTLAND: 98/100%, £48 to £50 ex store. MANCHESTER: £49 to £54 ex store.

ACID, SULPHURIC.—SCOTLAND: 144° quality, £3 12s. 6d.; 168°, £7; dearsenicated, 20s. per ton extra.

ACID, TARTARIC.—1s. per lb. less 5%, carriage paid for lots of 5 cwt. and upwards. SCOTLAND: 1s. 0¼d. less 5%. MANCHESTER: 1s. 0¾d. per lb.

ALUM.—SCOTLAND: Lump potash, £8 10s. per ton ex store.

ALUMINA SULPHATE.—LONDON: £7 10s. to £8 per ton. SCOTLAND: £7 to £8 ex store.

AMMONIA, ANHYDROUS.—Spot, 10d. per lb. d/d in cylinders. SCOTLAND: 10d. to 1s. containers extra and returnable.

AMMONIA, LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb., d/d.

AMMONIUM BICHROMATE.—8d. per lb. d/d U.K.

AMMONIUM CARBONATE. SCOTLAND: Lump, £30 per ton; powdered, £33, in 5-cwt. casks d/d buyers' premises U.K.

AMMONIUM CHLORIDE.—LONDON: Fine white crystals, £18 to £19. (See also Salammoniac.)

AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals. £32 to £35 per ton carriage paid according to quantity. (See also Salammoniac.)

ANTIMONY OXIDE.—SCOTLAND: Spot, £34 per ton, c.i.f. U.K. ports.

ANTIMONY SULPHIDE.—Golden, 6⅞d. to 1s. 3d. per lb.; crimson, 1s. 5½d. to 1s. 7d. per lb., according to quality.

ARSENIC.—LONDON: £16 10s. per ton c.i.f. main U.K. ports for imported material; Cornish nominal, £22 10s. f.o.r mines. SCOTLAND: White powdered, £23 ex wharf. MANCHESTER: White powdered Cornish, £23, ex store.

ARSENIC SULPHIDE.—Yellow, 1s. 5d. to 1s. 7d. per lb.

BARIUM CHLORIDE.—£11 per ton. SCOTLAND: £10 10s. to £10 15s.

BARYTES.—£6 10s. to £8 per ton.

BISULPHITE OF LIME.—£6 10s. per ton f.o.r. London.

BLEACHING POWDER.—Spot, 35/37%, £7 19s. per ton d/d station in casks, special terms for contract. SCOTLAND: £8 to £9 5s.

BORAX, COMMERCIAL.—Granulated, £14 10s. per ton; crystal, £15 10s.; powdered, £16; finely powdered, £17; packed in 1-cwt. bags, carriage paid home to buyer's premises within the United Kingdom in 1-ton lots.

CADMIUM SULPHIDE.—3s. 4d. to 3s. 8d per lb.

CALCIUM CHLORIDE.—Solid 70/75% spot, £5 5s. per ton d/d station in drums.

CARBON BISULPHIDE.—£31 to £33 per ton, drums extra.

CARBON BLACK.—3¾d. to 4⅞d. per lb. LONDON: 4½d. to 5d.

CARBON TETRACHLORIDE.—SCOTLAND: £41 to £43 per ton, drums extra.

CHROMIUM OXIDE.—10¾d. per lb., according to quantity d/d U.K.; green, 1s. 2d. per lb.

CHROMETAN.—Crystals, 3¼d. per lb.; liquor, £19 10s. per ton d/d.

COPPERAS (GREEN).—SCOTLAND: £3 15s. per ton, f.o.r. or ex works.

CREAM OF TARTAR.—£3 19s. per cwt. less 2½%. LONDON: £3 17s. per cwt. SCOTLAND: £4 2s. less 2½%.

DINITROTOLUENE.—66/68° C., 9d. per lb.

DIPHENYLGUANIDINE.—2s. 2d. per lb.

FORMALDEHYDE.—LONDON: £25 10s. per ton. SCOTLAND: 40%, £25 to £28 ex store.

IODINE.—Resublimed B.P., 6s. 3d. to 8s. 4d. per lb.

LAMPBLACK.—£45 to £48 per ton.

LEAD ACETATE.—LONDON: White, £34 10s. per ton; brown, £1 per ton less. SCOTLAND: White crystals, £33 to £35; brown, £1 per ton less. MANCHESTER: White, £34 10s.; brown, £32 10s.

LEAD NITRATE.—£27 10s. per ton.

LEAD, RED.—SCOTLAND: £24 to £26 per ton less 2½%; d/d buyer's works.

LEAD, WHITE.—SCOTLAND: £39 per ton, carriage paid. LONDON: £36 10s.

LITHOPONE.—30%, £17 to £17 10s. per ton.

MAGNESITE.—SCOTLAND: Ground calcined, £9 per ton, ex store.

MAGNESIUM CHLORIDE.—SCOTLAND: £7 per ton.

MAGNESIUM SULPHATE.—Commercial, £5 per ton, ex wharf.

METHYLATED SPIRIT.—61 O.P. industrial, 1s. 5d. to 2s. per gal.; pyridinised industrial, 1s. 7d. to 2s. 2d.; mineralised, 2s. 6d. to 3s. Spirit 64 O.P. is 1d. more in all cases and the range of prices is according to quantities. SCOTLAND: Industrial 64 O.P., 1s. 9d. to 2s. 4d.

NICKEL AMMONIUM SULPHATE.—£49 per ton d/d.

NICKEL SULPHATE.—£49 per ton d/d.

PHENOL.—7¾d. to 8¼d. per lb. to June 30; 6¾d. to 7½d. from July 1 to December 31.

POTASH, CAUSTIC.—LONDON: £42 per ton. MANCHESTER: £38 to £40.

POTASSIUM BICHROMATE.—Crystals and Granular, 5d. per lb. less 5% d/d U.K. Discount according to quantity. Ground, 5½d. LONDON: 5d. per lb. less 5%, with discounts for contracts. SCOTLAND: 5d. d/d U.K. or c.i.f. Irish Ports. MANCHESTER: 5d.

POTASSIUM CHLORATE.—LONDON: £37 to £40 per ton. SCOTLAND: 99¾/100%, powder, £37. MANCHESTER: £39.

Potassium Chromate.—6½d. per lb. d/d U.K.
Potassium Iodide.—B.P., 5s. 2d. per lb.
Potassium Nirate.—Scotland: Refined granulated, £29 per ton c.i.f. U.K. ports. Spot, £30 per ton ex store.
Potassium Permanganate.—London: 9¾d. per lb. Scotland: B.P. crystals, 10d. to 10½d. Manchester: B.P., 11¾d.
Potassium Prussiate.—London: Yellow, 8½d. to 8¾d. per lb. Scotland: Yellow spot, 8½d. ex store. Manchester: Yellow, 8½d.
Salammoniac.—First lump spot, £41 17s. 6d. per ton d/d in barrels. Scotland: Large crystals, in casks, £36.
Soda Ash.—58% spot, £5 12s. 6d. per ton f.o.r in bags.
Soda, Caustic.—Solid 76/77° spot, £13 17s. 6d. per ton d/d station. Scotland: Powdered 98/99%, £17 10s. in drums, £18 5s. in casks, Solid 76/77°, £14 12s. 6d. in drums; 70/73%, £14 12s. 6d., carriage paid buyer's station, minimum 4-ton lots; contracts 10s. per ton less. Manchester: £13 5s. to £14 contracts.
Soda Crystals.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.
Sodium Acetate.—£22 per ton. London: £22. Scotland: £20 15s.
Sodium Bicarbonate.—Refined spot, £10 10s. per ton d/d station in bags. Scotland: Refined recrystallised £10 15s. ex quay or station. Manchester: £10 10s.
Sodium Bichromate.—Crystals cake and powder 4d. per lb. net d/d U.K. discount according to quantity. Anhydrous, 5d. per lb. London: 4d. per lot less 5% for spot lots and 4d. per lb. with discounts for contract quantities. Manchester: 4d. per lb. basis. Scotland: 4d. delivered buyer's premises with concession for contracts.
Sodium Bisulphite Powder.—60/62%, £20 per ton d/d 1-cwt. iron drums for home trade.
Sodium Carbonate, Monohydrate.—£15 per ton d/d in minimum ton lots in 2 cwt. free bags. Soda crystals, Scotland: £5 to £5 5s. per ton ex quay or station. Powdered or pea quality, 7s. 6d. per ton extra. Light Soda Ash £7 ex quay, min. 4-ton lots with reductions for contracts.
Sodium Chlorate.—£32 10s. per ton. Scotland: 3⅝d. per lb.
Sodium Chromate.—4d. per lb. d/d U.K.
Sodium Hyposulphite.—Scotland: Large crystals English manufacture, £9 5s. per ton ex stations, min. 4-ton lots. Pea crystals, £14 10s. ex station, 4-ton lots. Manchester: Commercial, £10 5s.; photographic, £14 10s.
Sodium Meta Silicate.—£14 per ton, d/d U.K. in cwt. bags.
Sodium Iodide.—B.P., 6s. per lb.
Sodium Nitrite.—London: Spot, £18 5s. to £20 5s. per ton d/d station in drums.
Sodium Perborate.—10%, 9¾d. per lb. d/d in 1-cwt. drums. London: 10d. per lb.
Sodium Phosphate.—£13 per ton.
Sodium Prussiate.—London: 5d. to 5½d. per lb. Scotland: 5d. to 5¾d. ex store. Manchester: 5d. to 5½d.
Sulphur.—£9 15s. to £10 per ton. Scotland: £8 to £9.
Sodium Silicate.—140° Tw. Spot £8 per ton. Scotland: £8 10s.
Sodium Sulphate (Glauber Salts).—£4 2s. 6d. per ton d/d Scotland: English material £3 15s.
Sodium Sulphate (Salt Cake).—Unground spot, £3 12s. 6d. per ton d/d station in bulk. Scotland: Ground quality, £3 5s. per ton d/d. Manchester: £3 2s. 6d.
Sodium Sulphide.—Solid 60/62% Spot, £10 15s. per ton d/d in drums; crystals 30/32%, £8 per ton d/d in casks. Scotland: For home consumption, Solid 60/62%, £10 5s.; broken 60/62%, £11 5s.; crystals, 30/32%, £8 7s. 6d., d/d buyer's works on contract, min. 4-ton lots. Spot solid 5s. per ton extra. Crystals, 2s. 6d. per ton extra. Manchester: Concentrated solid, 60/62%, £11; commercial, £8 2s. 6d.
Sodium Sulphite.—Pea crystals spot, £13 10s. per ton d/d station in kegs. Commercial spot, £8 15s. d/d station in bags.
Sulphate of Copper.—Manchester: £14 5s. per ton f.o.b.
Sulphur Chloride.—5d. to 7d. per lb., according to quality.
Sulphur Precip.—B.P. £55 to £60 per ton according to quantity. Commercial, £50 to £55.
Vermilion.—Pale or deep, 4s. 5d. to 4s. 7d. per lb.
Zinc Chloride.—Scotland: British material, 98%, £18 10s. per ton f.o.b. U.K. ports.
Zinc Sulphate.—London: £12 per ton. Scotland: £10 10s.
Zinc Sulphide.—11d. to 1s. per lb.

Intermediates and Dyes

Acid, Benzoic, 1914 B.P. (ex Toluol).—1s. 9½d. per lb.
Acid, Gamma.—Spot, 4s. per lb. 100% d/d buyer's works.
Acid, H.—Spot, 2s. 4½d. per lb. 100% d/d buyer's works.
Acid Naphthionic.—1s. 8d. per lb.
Acid, Neville and Winther.—Spot, 3s. per lb. 100%.
Acid, Sulphanilic.—Spot, 8d. per lb. 100% d/d buyer's works.
Aniline Oil.—Spot, 8d. per lb., drums extra. d/d buyer's works.
Aniline Salts.—Spot, 8d. per lb. d/d buyer's works, casks free.
Benzaldehyde.—Spot, 1s. 8d. per lb., packages extra.
Benzidine Base.—Spot, 2s. 5d. per lb., 100% d/d buyer's works.
Benzidine HCL.—2s. 5d. per lb.
p Cresol 34-5° C.—2s. per lb. in ton lots.
m-Cresol 98/100%.—2s. 3d. per lb. in ton lots.
Dichloraniline.—1s. 11½d. to 2s. 3d. per lb.
Dimethylaniline.—Spot, 1s. 6d. per lb., package extra.
Dinitrobenzene.—8d. per lb.
Dinitrctoluene.—48/50° C., 9d. per lb.; 66/68° C., 01½d.
Dinitrochlorbenzene, Solid.—£72 per ton.
Diphenylamine.—Spot, 2s. per lb., d/d buyer's works.
α-Naphthol.—Spot, 2s. 4d. per lb., d/d buyer's works.
β-Naphthol.—Spot, £78 15s. per ton in paper bags.
α-Naphthylamine.—Spot, 11½d. per lb., d/d buyer's works.
β-Naphthylamine.—Spot, 2s. 9d. per lb., d/d buyer's works.
o-Nitraniline.—3ss. 11d. per lb.
m-Nitraniline.—Spot, 2s. 7d. per lb., d/d buyer's works.
p-Nitraniline.—Spot, 1s. 8d. per lb., d/d buyer's works.
Nitrobenzene.—Spot, 4½d. to 5d. per lb.: 5-cwt. lots, drums extra.
Nitronaphthalene.—9d. per lb.; P.G., 1s. 0½d. per lb.
Sodium Naphthionate.—Spot, 1s. 9d. per lb.
o-Toluidine.—9½d. to 11d. per lb. p-Toluidine.—1s. 11d. per lb.

Wood Distillation Products

Acetate of Lime.—Brown, £8 10s. to £9. Grey, £12 to £14. Liquor, brown, 30° Tw., 8d. per gal. Manchester: Brown, £11; grey, £13 10s.
Acetic Acid, Technical, 40%.—£17 to £18 per ton.
Charcoal.—£5 to £10 per ton.
Wood Creosote.—Unrefined, 3d. to 1s. 6d. per gal.
Wood Naphtha, Miscible.—2s. 6d. to 3s. 6d. per gal.; solvent, 3s. 3d. to 4s. 3d. per gal.
Wood Tar.—£2 to £4 per ton.

Coal Tar Products

Acid, Carbolic.—Crystals, 6¾d. to 8½d. per lb.; crude, 60's, 1s. 1½d. to 2s. 2½d. per gal. Manchester: Crystals, 7¼d. per lb.; crude, 2s. per gal. Scotland: 60's, 2s. 6d. to 2s. 7d.
Acid, Cresylic.—90/100%, 1s. 8d. to 2s. 3d. per gal.; pale 98%, 1s. 5d. to 1s. 6d.; according to specification. London: 98/100%, 1s. 4d.; dark, 95/97%, 1s. Scotland: Pale, 99/100%, 1s. 3d. to 1s. 4d.; dark, 97/99%, 1s. to 1s. 1d.; high boiling acid, 2s. 6d. to 3s.
Benzol.—At works, crude, 9½d to 10d. per gal.; standard motor, 1s. 3d. to 1s. 3½d.; 90%, 1s. 4d. to 1s. 4½d.; pure, 1s. 7½d. to 1s. 8d. London: Motor, 1s. 3½d. Scotland: Motor, 1s. 6½d.
Creosote.—B.S.I. Specification standard, 6d. per gal. f.o.r. Home, 3¾d. d/d. London: 4¼d. f.o.r. North; 5d. London. Manchester: 5d. to 5¾d. Scotland: Specification oils, 4d.; washed oil, 4¼d. to 4¾d.; light, 4½d.; heavy, 4½d. to 4¾d.
Naphtha.—Solvent, 90/100%, 1s. 5d. to 1s. 6d. per gal.; 95/160%, 1s. 6d.; 99%, 11d. to 1s. 1d. London: Solvent, 1s. 3½d. to 1s. 4½d.; heavy, 11d. to 1s. 0½d. f.o.r. Scotland: 90/160%, 1s. 3d. to 1s. 3½d.; 90/190%, 11d. to 1s. 2d.
Naphthalene.—Purified crystals, £10 per ton in bags. London: Fire lighter quality, £3 to £3 10s.; 74/76 quality, £4 to £4 10s.; 76/78 quality, £5 10s. to £6. Scotland: 40s. to 50s.; whizzed, 70s. to 75s.
Pitch.—Medium soft, 35s. per ton. London: 40s. per ton, f.o.b. East Coast port. Manchester: 32s. to 34s. f.o.b. East Coast. East Coast.
Pyridine.—90/140, 5s. 6d. to 8s. 6d. per gal.; 90/180, 2s. 3d.
Toluol.—90%, 1s. 11d. to 2s. per gal.; pure, 2s. 2d.
Xylol.—Commercial, 1s. 11d. to 2s. per gal.; pure, 2s. 1d. to 2s. 2d.

Nitrogen Fertilisers

Sulphate of Ammonia.—£7 5s. per ton; for neutral quality basis 20.6% nitrogen delivered in 6-ton lots to farmer's nearest station.
Cyanamide.—£7 5s. per ton delivered in 4-ton lots to farmer's nearest station.
Nitrate of Soda.—£7 12s. 6d. per ton for delivery in 6-ton lots, carriage paid to farmer's nearest station for material basis 15.5% or 16% nitrogen.
Nitro-Chalk.—£7 5s. per ton in 6-ton lots carriage paid for material basis 15.5% nitrogen.
Concentrated Complete Fertilisers.—£10 5s. to £10 17s. 6d. per ton according to percentage of constituents, for delivery in 6-ton lots carriage paid.
Nitrogen Phosphate Fertilisers.—£10 5s. to £13 15s. per ton.

Latest Oil Prices

London, July 3.—Linseed Oil was quiet. Spot, £23; small quantities, July and Aug., £20 7s. 6d.; Sept.-Dec., £20 5s.; Jan.-April, £20 10s., naked. Soya Bean Oil was steady. Oriental (bulk), July-Aug. shipment, £17 5s. Rape Oil was slow. Crude extracted, £32; technical refined, £33 10s., naked ex wharf. Cotton Oil was dull. Egyptian crude, £23 10s.; refined common edible, £26 10s.; deodorised, £28 10s.; naked, ex mill (small lots £1 10s. extra). Turpentine was easier. American, spot, 42s. per cwt.

Hull.—Linseed Oil, spot, quoted £21 7s. 6d. per ton. July-Aug., £20 15s.; Sept.-Dec., £20 10s. Cotton Oil, Egyptian, crude, spot, £24; edible, refined, spot, £27; technical, spot, £27; deodorised, £29, naked. Palm Kernel Oil, crude, f.m.q., spot, £20, naked. Groundnut Oil, extracted, spot, £30 10s.; deodorised, £33 10s. Rape Oil, extracted, spot, £31; refined, £32 10s. Soya Oil, extracted, spot, £21 10s.; deodorised, £24 10s. per ton. Castor Oil, pharmaceutical, 41s. per cwt., first, 36s.; seconds, 33s. Cod Oil, f.o.r or f.a.s., 25s. per cwt. in barrels. Turpentine.—American, spot, 44s. per cwt.

Chemical and Allied Stocks and Shares

Current Quotations

The following table shows this week's Stock Exchange quotations of chemical and allied stocks and shares compared with those of last week. Except where otherwise shown the shares are of £1 denomination.

Name.	July 2.	June 25.
Anglo-Persian Oil Co., Ltd. Ord.	61/3	61/3
,, 8% Cum. Pref.	36/9	37/-
,, 9% Cum. Pref.	37/9	38/-
Associated Dyers and Cleaners, Ltd. Ord.	1/10½	1/10½
,, 6½% Cum. Pref.	4/8¼	4/8¼
Associated Portland Cement Manufacturers, Ltd. Ord.	55/-	54/6
,, 5½% Cum. Pref.	27/3	27/3
Benzol & By-Products, Ltd. 6% Cum. Part Pref.	2/6	2/6
Berger (Lewis) & Sons, Ltd. Ord.	61/3	61/3
Bleachers' Association, Ltd. Ord.	6/3	6/-
,, 5½% Cum. Pref.	8/9	8/9
Boake, A., Roberts & Co., Ltd. 5% Pref. (Cum.)	21/3	21/3
Boots Pure Drug Co., Ltd. Ord. (5/-)	49/6	49/3
Borax Consolidated, Ltd. Pfd. Ord. (£)	97/6	97/6
,, Defd. Ord.	16/-	15/9
,, 5½% Cum. Pref. (£10)	£11/2/6	£11/2/6
,, 4½% Deb. (1st Mort.) Red. (£100)	£109	£109
,, 4½% 2nd Mort. Deb. Red. (£100)	£103	£103
Bradford Dyers' Association, Ltd. Ord.	8/9	8/9
,, 5% Cum. Pref.	11/10½	11/10½
,, 4% 1st Mort. Perp. Deb. (£100)	£82/10/-	£82/10/-
British Celanese, Ltd. 7% 1st Cum. Pref.	26/9	27/-
,, 7½% Part. 2nd Cum. Pref.	22/9	22/9
British Cotton & Wool Dyers' Association Ltd. Ord. (5/-)	5/-	5/-
,, 4% 1st Mort. Deb. Red. (£100)	£91	£91
British Cyanides Co., Ltd. Ord. (2/-)	3/7½	3/7½
British Drug Houses, Ltd. Ord.	20/-	20/-
,, 5% Cum. Pref.	22/6	22/6
British Glues and Chemicals, Ltd. Ord. (4/-)	5/3	4/3
,, 8% Pref. (Cum. and Part.)	30/-	26/10½
British Oil and Cake Mills, Ltd. Cum. Pfd. Ord.	48/9	48/9
,, 5½% Cum. Pref.	26/3	26/3
,, 4¼% First Mort. Deb. Red. (£100)	£107/10/-	£108/10/-
British Oxygen Co., Ltd. Ord.	111/3	117/6
,, 6½% Cum. Pref.	31/10½	31/10½
British Portland Cement Manufacturers, Ltd. Ord.	91/3	90/-
,, 6% Cum. Pref.	31/-	30/-
Bryant & May, Ltd. Pref.	67/6	67/6
Burt, Boulton & Haywood, Ltd. Ord.	20/-	20/-
,, 7% Cum. Pref.	27/6	27/6
,, 6% 1st Mort. Deb. Red. (£100)	£105/10/-	£105/10/-
Bush, W. J., & Co., Ltd. 5% Cum. Pref. (£5)	105/-	105/-
,, 4% 1st Mort. Deb. Red. (£100)	£96/10/-	£96/10/-
Calico Printers' Association, Ltd. Ord.	11/3	10/-
,, 5% Pref. (Cum.)	17/6	17/6
Cellulose Acetate Silk Co., Ltd. Ord.	12/-	12/-
,, Deferred (1/-)	2/4½	2/4½
Consett Iron Co., Ltd. Ord.	7/3	7/3
,, 8% Pref.	23/9	23/1½
,, 6% First Deb. stock, Red. (£100)	£105/10/-	£103
Cooper, McDougall & Robertson, Ltd. Ord.	36/3	36/3
,, 7% Cum. Pref.	30/-	29/6
Courtaulds, Ltd. Ord.	59/3	59/6
,, 5% Cum.	26/3	26/3
Crosfield, Joseph, & Sons, Ltd. 5% Cum. Pre-Pref.	25/-	25/-
,, Cum. 6% Pref.	28/9	28/9
,, 6½% Cum. Pref.	28/9	28/9
,, 7½% "A" Cum. Pref.	30/7½	30/7½
Distillers Co., Ltd. Ord.	94/6	95/6
,, 6% Pref. Stock Cum.	32/-	32/-
Dorman Long & Co., Ltd. Ord.	19/-	19/4½
,, Prefd. Ord.	21/6	22/-
,, 6½% Non-Cum. 1st Pref.	21/10½	21/9
,, 8% Non-Cum. 2nd Pref.	20/-	20/7½
,, 4% First Mort. Perp. Deb. (£100)	£103	£102/10/-
,, 5% 1st Mort. Red. Deb. (£100)	£104	£103/10/-

Name.	July 2.	June 25.
English Velvet & Cord Dyers' Association, Ltd. Ord.	4/4½	4/4½
,, 5% Cum. Pref.	8/1½	8/1½
,, 4% First Mort. Deb. Red. (£100)	£65	£65
Fison, Packard & Prentice, Ltd. Ord.	38/9	38/9
,, 7% Non-Cum. Pref.	30/-	30/-
,, 4½% Debs. (Reg.) Red. (£100)	£106	£107
Gas Light & Coke Co. Ord.	28/-	28/-
,, 3½% Maximum Stock (£100)	£88/10/-	£87/10/-
,, 4% Consolidated Pref. Stock (£100)	£108/10/-	£108/10/-
,, 3% Consolidated Deb. Stock, Irred. (£100)	£89/10/-	£89/10/-
,, 5% Deb. Stock, Red. (£100)	£115/10/-	£115/10/-
,, 4½% Red. Deb. Stock (1960-65) (£100)	£111/10/-	£111/10/-
Goodlass Wall & Lead Industries, Ltd. Ord. (10/-)	12/6	12/6
,, 7% Prefd. Ord. (10/-)	13/1½	13/1½
,, 7% Cum. Pref.	28/9	28/9
Gossage, William, & Sons, Ltd. 5% 1st Cum. Pref.	24/4½	24/4½
,, 6½% Cum. Pref.	28/9	28/9
Imperial Chemical Industries, Ltd. Ord.	36/3	35/9
,, Deferred (10/-)	8/9	8/9
,, 7% Cum. Pref.	33/6	33/6
Imperial Smelting Corporation, Ltd. Ord.	13/9	13/9
,, 6½% Pref. (Cum.)	23/9	23/9
International Nickel Co. of Canada, Ltd. Cum.	$27⅜	$28⅛
Johnson, Matthey & Co., Ltd. 5% Cum. Pref. (£5)	95/-	95/-
,, 4% Mort. Deb. Red. (£100)	£98/10/-	£98/10/-
Laporte, B., Ltd. Ord.	107/6	107/6
Lawes Chemical Manure Co., Ltd. Ord. (1/-)	5/7½	5/7½
,, 7% Non-Cum. Part Pref. (10/-)	10/-	10/-
Lever Bros. Ltd. 7% Cum. Pref.	32/6	32/6
,, 8% Cum. "A" Pref.	32/9	32/9
,, 20% Cum. Prefd. Ord.	79/4½	79/4½
,, 5% Cons. Deb. (£100)	£109/10/-	£109/10/-
,, 4% Cons. Deb. (£100)	£105	£105
Magadi Soda Co., Ltd. 12½% Pref. Ord. (5/-)	1/3	1/3
,, 6% 2nd Pref. (5/-)	6d.	6d.
,, 6% 1st Debs. (Reg.)	£58	£58
Major & Co., Ltd. Ord. (5/-)	7½d.	7½d.
,, 8% Part. Prefd. Ord. (10/-)	9d.	9d.
,, 7½% Cum. Pref.	1/10½	1/6¾
Mond Nickel Co., Ltd. 5½% Mort. Deb. Red. (£100)	—	£103
Pinchin, Johnson & Co., Ltd. Ord. (10/-)	44/-	44/-
,, 7% Cum. Pref.	33/1½	33/1½
Potash Syndicate of Germany (Deutsches Kalisyndikat G.m.b.H.) 7% Gld. Ln. Sr. "A" and "B" Rd.	£69	£69
Reckitt & Sons, Ltd. Ord.	113/9	113/9
,, 4½% Cum. 1st Pref.	25/-	25/-
Salt Union, Ltd. Ord.	41/3	41/3
,, Pref.	46/3	46/3
,, 4½ Deb. (£100)	£109/10/-	£109/10/-
South Metropolitan Gas Co., Ord. (£100)	£125/10/-	£129/10/-
,, 6% Irred. Pref. (£100)	£149/10/-	£149/10/-
,, 4% Pref. (Irred.) (£100)	£106/10/-	£106/10/-
,, Perpetual 3% Deb. (£100)	£88/10/-	£89/10/-
,, 5% Red. Deb. 1950-60 (£100)	£115/10/-	£115/10/-
Staveley Coal & Iron Co., Ltd. Ord.	44/4½	44/4½
Stevenson & Howell, Ltd., 6¼% Cum. Pref.	26/3	26/3
Triplex Safety Glass Co., Ltd. Ord. (10/-)	70/-	70/7½
Unilever, Ltd. Ord.	28/9	30/7½
,, 7% Cum. Pref.	30/7½	29/9
United Glass Bottle Manufacturers, Ltd. Ord.	42/-	42/6
,, 7½% Cum. Pref.	33/-	33/-
United Molasses Co., Ltd. Ord. (6/8)	20/7½	20/7½
,, 6% Cum. Pref.	25/-	25/-
United Premier Oil & Cake Co., Ltd. Ord. (5/-)	7/-	6/9
,, 7% Cum. Pref.	23/9	23/9
,, 6% Deb. Red. (£100)	£101	£101

From Week to Week

Glyco Products Co., Inc., of Brooklyn, New York, have published a new revised catalogue containing valuable information and formulæ on emulsions, polishes, abrasives, disinfectants, bronze lacquers, synthetic resins and waxes, adhesives, etching pastes, cutting and spraying oils, soluble oils, etc.

The June issue of "Sands, Clays and Minerals" contains interesting articles on radium discoveries in North-West Canada; uses of zirconium; silicosis in industry; lead and tin mining; magnesite bricks; the briquetting of small coal; and Tasmania's mineral resources. There is also an article on 8-hydroxyquinoline as an analytical reagent.

Stewarts and Lloyds, Ltd., have just published a handy pocket catalogue giving some idea of the many different types of coils which are in use to-day. This catalogue also contains a useful table giving surface areas of tubes per foot run. The illustrations which are all in line have been treated in a rather unusual but striking manner.

Germany's largest potash producers, the Wintershall Co., has informed shareholders that Germany's potash sales during the first six months of 1935 exceeded the same period of 1934 by more than 100,000 metric tons, chiefly owing to increased exports. Exports during the first half of the present year increased to 22 per cent. of the total potash deliveries, from 17 per cent. last year.

The International Nitrate Conference, which is being attended by delegates from Britain, Germany, Chile and other countries, opened at Scheveningen, in Holland, on June 28. The principal item on the agenda is the renewal of the international convention. On July 2 the conference was postponed as it had been found impossible to settle difficulties in the way of a new agreement.

Rayon output during May soared to the new high level of 11,100,000 lb., easily surpassing the previous peak of 10,730,000 lb. reached in March. The record is scarcely surprising as daily production in April averaged around 408,000 lb.—or a total of 9,790,000 lb. The May, 1935, figure gives a striking indication of expansion when compared with the comparable 1933 and 1934 totals of 7,170,000 lb. and 7,720,000 lb. respectively.

In response to an application by workers, employers in the bleaching, dyeing, finishing and calico printing trade have announced that they are not prepared to agree to a general wages advance. Negotiations have now been broken off, and a meeting of the leaders of the unions involved will be held in Bradford to-day to discuss the question of a withdrawal of labour. The current agreement expires on July 8, and notice to terminate it was given by the unions three months ago.

Notice of proposals for the amalgamation of three rubber companies operating in the Malay districts with headquarters in Edinburgh have been issued to the shareholders. The companies are the Kenny Selanger Rubber Co., the Riverside Selanger Rubber Co., and the Scottish Malay Rubber Co. The new company will be known as the Scottish Malayan Estates, Ltd. In a memorandum issued to the shareholders it is stated that the new company is to be formed to absorb the three companies with effect from January 1, 1935, and will have a nominal capital of £500,000.

British Glues and Chemicals, Ltd., have decided to pay on July 31 two half-yearly fixed dividends on the 8 per cent. cumulative participating preference shares, bringing the preference dividends up to date. Issued preference capital totals £525,000. Half-yearly payments were made in October and February last.

The Birkenhead Town Council has been informed that the cost of completing the investigation, by the Department of Scientific and Industrial Research, into the question of the discharge of sewage into the Mersey will exceed the estimate of £20,000 by £7,000 or £8,000.

The authorised capital of British Oxygen, Ltd., it is announced, is to be increased to £3,500,000, by the creation of 1,250,000 ordinary shares of £1 each. The existing issued capital is £1,657,116. A new issue of shares is to be made to the company's shareholders, one new share being offered at the price of 70s. for each £6 stock already held.

The chemical industry in Scotland has had quite a satisfactory year. The increase in trade experienced during 1933 has been maintained, and returns received from manufacturers show that increased production has taken place in most of the heavy chemical industries. Acid production has exceeded the 1933 level by about 20 per cent., and there has been an increase of ten per cent. in the amount of sulphate of ammonia manufactured.

Shareholders of Anglo-Persian Oil Co., Ltd., at a meeting held in London on June 27, agreed to the name of the company being changed to Anglo-Iranian Oil Co., Ltd. Sir John Cadman, who presided, said the process of developing the Haft Kel field continued during the year. Further drilling confirmed the results of earlier wells, and the proved area has been so much extended that it is now approximately equal to that of Masjidi-i-Sulaiman. The provision of more pipe-line facilities was put in hand towards the end of 1934, and has since been completed.

Shareholders of British Plaster Board, Ltd., are to meet on July 23, to consider resolutions increasing the capital to £850,000, by the creation of 100,000 7 per cent. cumulative preference shares of £1 each, and 1,000,000 ordinary shares of 5s. each. This increase is necessitated by the agreement which the directors have provisionally entred into, with the object of acquiring the whole, or not less than 90 per cent. of the share capital of the Gypsum Mines, Ltd. The capital of the Gypsum Mines, Ltd., is £250,000, in 100,000 7 per cent. cumulative preference shares of £1 each, and 150,000 ordinary shares of £1 each.

The Import Duties Advisory Committee give notice of applications for increases in the import duties on vegetable oils and oil seed cake and meal; condensed milk, milk powder and other preserved milk; buttermilk powder and whey powder. Any representations which interested parties may desire to make in regard to these applications should be addressed in writing to the Secretary, Import Duties Advisory Committee, Caxton House (West Block), Tothill Street, Westminster, London, S.W.1, not later than July 15, 1935. The committee announce that they have decided not to make any recommendation in respect of the application previously advertised for the addition to the free list of magnesium sulphate.

Company News

Webb's Crystal Glass.—The report for 1934 shows a balance (after bringing in £1,830 tax recovered) of £910. No dividend has been paid since 1931.

Electrolytic Zinc Co. of Australia.—An ordinary dividend of 5 per cent. is announced for the year to June 30 last, compared with 4 per cent. last year. No payment was made on account of 1931, 1932, and 1933. Payment at the rate of 8 per cent. per annum for the six months to June 30 will also be made on the preference shares.

British Glues and Chemicals.—The report for the year to April 30 last shows net profit, excluding surplus on realisation of investments, which have been used to write down fixed assets, £71,471, against £45,726 last year; to this is added £13,745 brought in and £5,000 from tax reserve, making £120,217; dividends on 8 per cent. preference for 1933-34 and for the year to April 30 last absorb £84,000; the amount carried forward is £36,217.

Savory and Moore.—The trading profits for the year to January 31 last, show an increase of £8,036 on the year at £46,147. Depreciation takes £4,694, and after all expenses, debenture interest, amortisation of leasehold properties, etc., a balance of £18,932 remains, including £8,394 brought in. The amount to be carried forward is raised to £8,592, after payment of dividends on the 6 per cent. and 7½ per cent. preference shares, and transferring £2,390 to debenture sinking fund.

New Transvaal Chemical Co.—For the half-year to December 31 last the payment is announced of 3 per cent. (less tax) on the cumulative first preference shares and of 4 per cent. (less tax) on the cumulative "A" preference shares.

English China Clays.—The payment is announced of a year's dividend on the 7 per cent. cumulative preference shares. This dividend, which will be paid on July 22, brings the payment of arrears of dividend on these shares up to December 31, 1934.

The Distillers Co.—A final dividend of 12½ per cent., less tax, has been declared on the ordinary shares for the year to May 15 last. This makes a total of 20 per cent. for the year, the same as for the previous year. For 1932-33 a 17½ per cent. dividend was paid. A further recovery in net profits is indicated by the preliminary statement. A sum of £350,000 is placed to reserve, against £250,000, and £2,734 more is carried forward at £319,073.

The Powell Duffryn Steam Coal Co.—The report for the year to March 31 last shows a trading profit of £450,284. For the previous fifteen months' trading, profit amounted to £618,581. Debenture interest takes £119,574, against £232,423, and after providing for fees and £100,000 for depreciation, against £92,500 last year, the net profit is £221,032. The final ordinary dividend is 4½ per cent., making 6 per cent. for the year. For the previous fifteen months 6½ per cent. was paid.

Aberthaw and Bristol Channel Portland Cement Co.—It is announced that the company is resuming ordinary dividends with a payment of 5 per cent. and a bonus of 2½ per cent., both less tax, in respect of the year to March 31 last. No payment was made in respect of 1933-1934, but 5 per cent. was paid for 1932-33 and 6 per cent. for the two preceding years, while 8¾ per cent. was forthcoming for 1929-30. Trading profit for the past year is shown at £50,646, compared with £44,615 a year ago, while the balance brought forward was £44,268, making a sum of £94,924 available. After providing for debenture charges, fees, etc., and preference requirements, and meeting the ordinary distribution, a balance of £36,392 is carried forward.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

(NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

MASSON SEELEY AND CO., LTD., London, S.W., chemical engineers, etc. (M., 6/7/35.) Reg. June 21, £5,000 1st deb., to Bishopsgate Nominees, Ltd., 15 Bishopsgate, E.C.; general charge, excluding certain hire-purchase agreements, etc. *£3,000. Apr. 19, 1935.

Satisfactions

ANGLO-PERSIAN OIL CO., LTD., London, E.C. (M.S., 6/7/35.) Satisfaction reg. June 20, of 1st deb. stock reg. June 4, 1909, Mar. 27, 1918, Jan. 23, 1920, and Feb. 18, 1924, to extent of £4,850,000, the balance outstanding.

County Court Judgments

(NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court Judgments against him.)

LLOYD-OWEN, Jno., King's Lynn, 29 Cornwallis Gardens, Hastings, analytical chemist. (C.C., 6/7/35.) £21 14s. 6d. May 27.

KELCO PRODUCTS CO. (sued as a firm), 153 Camberwell Road, S.E., manufacturing chemists. (C.C., 6/7/35.) £26 0s. 6d. May 24.

COWPER-COLES, Sherard, and Cowper-Coles, Constance H. (his wife), Rossall House, Sunbury-on-Thames, consulting engineer and metallurgist. (C.C., 6/7/35.) £22 18s. 10d. May 27.

INSECTICIDES AND CHEMICALS, LTD., 204 Gt. Portland Street, W. (C.C., 6/7/35.) £12 17s. 10d. May 17.

INSECTICIDES AND CHEMICALS, LTD., 93 Baker Street, W., chemists. (C.C., 6/7/35.) £26 18s. 0d. May 9.

WATKINS AND LAING (LONDON), LTD., 64/68 Pitfield Street, N., mfg. chemists. (C.C., 6/7/35.) £20 5s. 9d. May 31.

London Gazette, etc.

Companies Winding-up Voluntarily

PURE OIL CO., LTD. (C.W.U.V., 6/7/35.) By special resolution, June 27. Mr. Charles Joseph Pereira, Barclays Bank Building, 73 Cheapside, London, E.C.2, appointed liquidator.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

Norway.—A firm of agents established at Oslo wishes to obtain the representation, on a commission basis, of United Kingdom manufacturers of lubricating oils. (Ref. No. 29.)

China (Shanghai).—A United Kingdom company manufacturing varnishes, paints, etc., desire to obtain for their Shanghai representative agencies for kindred but non-competing lines. (Ref. No. 24.)

New Companies Registered

I.P.S. Co., Ltd., Walter House, Strand, London.—Registered May 22. Nominal capital £1,000. Chemists, drysalters, manufacturers of and dealers in chemical and other preparations.

G. P. Concessions, Ltd.—Registered May 27. Nominal capital £1,000. Manufacturers, producers, dealers in chemicals, drugs, chemical products. Directors: Harry D. Langridge, 11 Torrington Road, Claygate, Ivy A. Lapworth.

Hooley and Sheldon (Chemists), Ltd.—Private company. Registered May 28. Nominal capital £700. Consulting, analytical, manufacturing, pharmaceutical and general chemists. Directors: Ronald Hooley, 136 Norwood Road, Southport, Wm. Sheldon.

D.C.M. Products, Ltd.—Registered May. Nominal capital £1,000. Dealers in, agents for, importers, exporters and manufacturers of water-softeners and appliances, metalworkers, moulders and smelters. Directors: Leon Caulmans, 41 The Roystons, Surbiton, Charles Monseur, Robert De Reytere.

Rayner and Wardle, Ltd.—Registered May 27. Nominal capital £5,000. Tanning material manufacturers and merchants, oil merchants and manufacturers, drysalters, oil extractors, refiners, distillers. A subscriber: Lewis Asquith, 22 Regent Park Avenue, Hyde Park, Leeds, 6.

Pickford Experimental Co., Ltd., M.W. Service Station, Pickford, Allesley, Coventry.—Registered June 7. Nominal capital £100. Designers, inventors, patentees and manufacturers of and dealers in machinery, engines and apparatus; mechanical, motor, electrical, experimental and general engineers, etc. Directors: Francis B. Levetus, Geo. V. Keeling.

H. C. Products, Ltd., 7 Finsbury Square, London, E.C.2.—Registered June 15. Nominal capital £5,000. Manufacturing and research chemists and chemical engineers (especially in relation to the treatment of coal, lignites, shale and peat), chemical and engineering consultants, etc. Directors: John Lackett, Malcolm E. Cresswell.

Godfrey Woodhead and Son, Ltd., Britannia Chemical Works, Slaithwaite, near Huddersfield.—Registered May 31. Nominal capital £15,000. To acquire the business of chemical manufacturers and merchants carried on as Godfrey Woodhead and Son, at Slaithwaite, near Huddersfield. Directors: Joe Bamforth, Jas. H. Crossley, Maj. Lionel B. Holliday, Geo. D. Bamforth, Winfred W. Crossley.

Bentonite, Ltd., Halifax House, 62-4 Moorgate, London, E.C.—Registered as a "public" company on June 7. Nominal capital £50,000. To enter into an agreement with Heyman Orkin, to carry on, develop and turn to account the properties, rights and interests therein mentioned, and to carry on the business of miners, manufacturers and merchants of bentonite and fuller's earth, clay, stone and other minerals, etc. Directors: Heyman Orkin, Arthur H. Pollen, 238 St. James' Court, Buckingham Gate, S.W.1.

Consolidated Rubber Manufacturers, Ltd.—Registered as a public company on May 30. Nominal capital, £600,000. Producers and manufacturers of and dealers in rubber, vegetable and other gums, chemicals, fabrics, preparations, solutions, treatments and articles, including proprietary articles of all kinds, etc. Directors:—Wm. A. Eden, 688 Grosvenor Avenue, Quebec, Canada; Wm. de Krafft, Reed P. Rose (managing director of International Latex Processes, Ltd.), Francis N. Pickett (chairman of Rubber Regenerating Co., Ltd.), Sir Malcolm Campbell, "Povey Cross," Horley, Surrey.

Books Received

The Discovery of Specific and Latent Heats. By Douglas McKie and Niels H. de V. Heathcote. London: Edward Arnold and Co. Pp. 156. 6s.

The Handbook of Butane-Propane Gases. Arranged and Edited by George H. Finley. California: Western Gas. Pp. 375. $5.00.

B.D.H. Reagents for "Spot" Tests. Fourth Edition. London: British Drug Houses, Ltd. Pp. 82. 2s. 6d.

The Principles of Motor Fuel Preparation and Application. By Alfred W. Nash and Donald A. Howes. London: Chapman and Hall, Ltd. Pp. 524. 30s.

Das Wasser in der Industrie und im Haushalt. By J. Leick. Dresden and Leipzig: Verlag von Theodor Steinkopff. Pp. 119. RM.9.

Official Publications

The Quaternary System $CaO-Al_2O_3-SiO_2-Fe_2O_3$ in Relation to Cement Technology. Building Research Technical Paper No. 16. London: H.M. Stationery Office. Pp. 52. 1s.

Bulletin of the Imperial Institute. Vol. XXXIII. No. 1. 1935. London: John Murray. Pp. 122. 3s. 6d.

Economic Conditions in Japan. 1933-34. By G. B. Sansom and H. A. MacRae. London: H.M. Stationery Office. Pp. 160. 3s. 6d.

Imperial College of Science and Technology, South Kensington. Twenty-Seventh Annual Report. July 31, 1934. London: H.M. Stationery Office. Pp. 121. 2s.